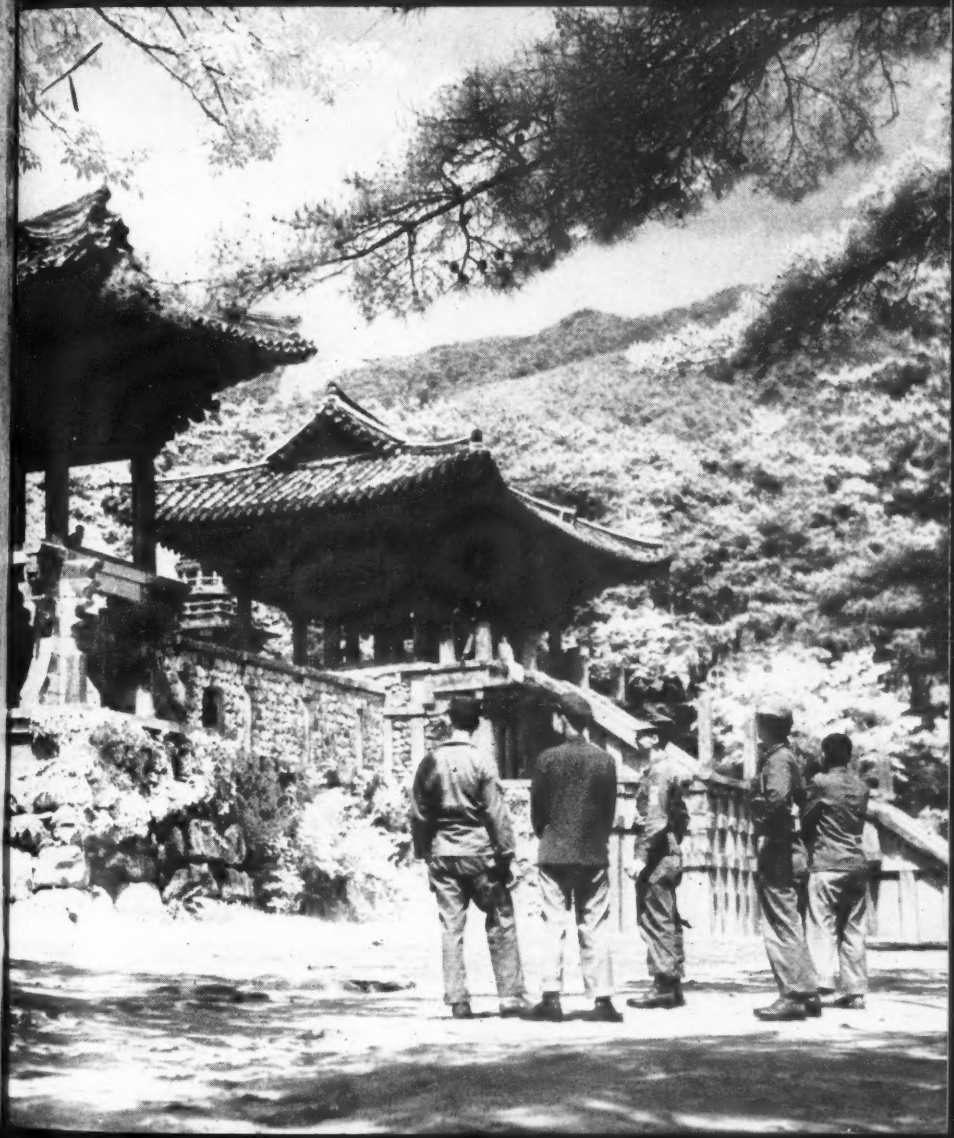
JULY 1954

# ARMY INFORMATION DIGEST



## *In This Issue:*

REPORT ON NATO'S FIFTH YEAR. The growing menace of Communist aggression has brought with it added responsibilities for military co-operation with the Free Nations in the North Atlantic Treaty Organization. Five years of achievement in "Building Strength for Western Defense" are reviewed by General J. Lawton Collins, U. S. Representative on the Military Committee and the Standing Group of the North Atlantic Treaty Organization.

ATTENTION IS INVITED to the questionnaire, "A Survey of Our Readers" beginning on page 31. Readers views are sought on this form or in a separate communication as a means of making the DIGEST increasingly valuable as a tool of Army information. Commanders are invited to reproduce and distribute this form locally so that the opinions of a representative cross section of readers may be made available for guidance of the DIGEST staff.

THE CLICK OF A CAMERA SHUTTER portends devastating fire power to come, now that photography is being widely used in support of combat operations. Tell-tale signs of road blocks, mine fields, troop concentrations and other types of tactical intelligence are gathered by "Cameras on the Battlefield."

ANOTHER TOP-LEVEL PROGRAM—organizing military supply as an orderly business operation—is making substantial progress under the Assistant Chief of Staff G4, Logistics. As a result, "The Army Gets More for its Dollar."

POST-COMBAT SCENES of Eighth Army activities are recorded by Signal Corps photographers on the front cover and in a pictorial section on "Korea—One Year Later."

IN "AIRBORNE OPERATIONS," the Director of the Joint Airborne Troop Board tells how air mobility of ground forces, by radically altering the space and time factors in warfare, has added a new dimension to tactics and strategy.

THE CHRONICLE of small arms development, from flintlock through semi-automatic, is also the history of Springfield Armory. This "Pioneer in Small Arms" contributed importantly to the manufacture and improvement of the Army's basic weapon over the past 160 years.

METHODICAL ARMY PROCEDURES extend even to the selection of appropriate names for posts, camps and stations. Functions of the Army Memorialization Board are described by The Adjutant General in "What's in a Name."

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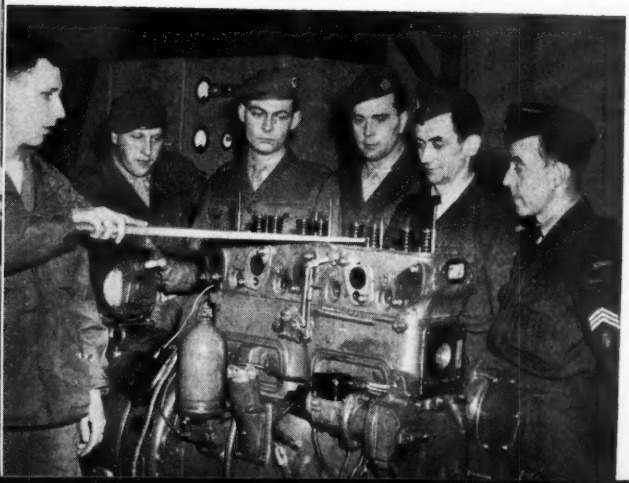

**Instruction**

# Building Strength For Western Defense

**General J. Lawton Collins**

SHORTLY after the United States joined in the establishment of the United Nations at San Francisco in 1945, it became apparent that intransigence and bad faith on the part of certain members threatened the effectiveness of the United Nations as an instrument for world peace.

A new aggressor, backed by the largest army in the world, began pursuing imperialistic expansion even beyond that of past Emperors, Czars, Kaisers and Hitlers. By 1948 six nations in Europe had been enslaved behind the Iron Curtain and when Czechoslovakia succumbed in February of that year, the "Western Union"—an alliance of the United Kingdom, France and the Benelux countries—was formed. This was the closest blood relation of the North Atlantic Treaty Organization (NATO), now in its fifth year of operation.

In 1948 the United States Senate in the language of the famous Vandenberg Resolution called for the "association of the United States, by constitutional process, with such regional and other collective arrangements as are based on continuous and effective self-help and mutual aid, and as affect its national security." Following this resolution, negotiations were undertaken with other countries in the Atlantic Basin leading to the signature of the North Atlantic Treaty on 4 April 1949.

This collective security concept to which Senator Vandenberg referred is most highly developed in the North Atlantic Treaty Organization. Here are fourteen nations—Belgium, Canada, Denmark, France, Greece, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, Turkey, United Kingdom and the United

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*GENERAL J. LAWTON COLLINS, USA, is United States Representative on the Military Committee and the Standing Group of the North Atlantic Treaty Organization. This statement is from an address before the Continental Congress of the Daughters of the American Revolution.*

States—joined together, despite diverse customs, languages, economies and political structures, because each is determined to maintain its freedom and independence.

The Treaty is in strict conformity with the principles and intentions of the United Nations Charter and seeks to apply those principles effectively in a partnership of like-minded nations "so that they can unite their efforts for collective defense and for the preservation of peace and security." Article 51 of the United Nations Charter, referred to in Article V of the Treaty, explicitly upholds "the inherent right of individual or collective self-defense."

The Treaty's "teeth" are contained in Article V which reads, in part: "The Parties agree that an armed attack against one or more of them in Europe or North America shall be considered an attack against them all and consequently they agree that if such an armed attack occurs, each of them, in exercise of the right of individual or collective self-defense recognized by Article 51 of the Charter of the United Nations, will assist the Party or Parties so attacked by taking forthwith, individually and in concert with the other Parties, such action as it deems necessary, including the use of armed force, to restore and maintain the security of the North Atlantic area."

NATO is unique in that for the first time in history, a group of nations have joined in a common purpose before, rather than after, a general war has broken out and have actually dispatched forces under international field commands which could act, in the event of war, in the common defense.

In this Treaty, the people of the United States have declared in effect that the security of Western Europe is vital to the security of the United States and the defense of the United States —and we are determined to fight if the freedom of any of these nations is menaced by an aggressor. This firm and unequivocal commitment looks to the creation of a position of strength that will make aggression so unprofitable that it will never take place. Peace may thus be secured, making possible the continuous development of our way of life and the maintenance of our standard of living.

The military threat arises from only one source—the Communist bloc—a potential foe of unpredictable intent and ruthless power. While the Western powers demobilized precipitately following World War II and practically wrecked the military

machine that had achieved final victory, the numbers and status of the Soviet forces remained deployed and poised as for war. East of the Iron Curtain are the world's largest armies—one hundred and seventy-five Soviet divisions, of which one-third are either mechanized or armored, and seventy additional satellite divisions—equipped with more than forty thousand tanks. Soviet air power is estimated at some twenty thousand operational aircraft, including many jet types. Soviet naval forces include about twenty cruisers and three hundred submarines of various types. Soviet nuclear weapons are on the increase.

This is in many ways the most formidable military establishment the world has ever known. It is based on a vast Communist empire with a population of 800,000,000 dominating the Central Eurasian land mass, from the Elbe to the Pacific. It threatens by land any one of approximately twenty nations of Europe, the Middle East and Asia, and by air it could strike the North American continent.

Confronted by this unpredictable foe of great military power and faced by the fact that the free world will never launch a preventive war, if war comes we are bound to receive the first blow. It may well be hurled at Western Europe and the Western Hemisphere simultaneously, because such attack would damage the free world most.

Our concept of defense is not one of matching division for division, ship for ship, plane for plane. Rather it rests, first, on the creation of a defensive shield designed to prevent the overrunning of Europe and to nullify direct attack on the United States; and second, on the creation of counter-offensive forces, mostly air, with the requisite bases, possessing the capacity for devastating counterblows if the Communists launch an attack.

In Europe our defenses rest on highly mobile Army divisions supported by hard-hitting tactical air forces, backed up by reserve forces which would be brought into action immediately after the outbreak of hostilities. These covering forces should give us the necessary time to mobilize the added reserves needed. The remainder of our shield comprises our naval forces in the Atlantic, our Army forces in Alaska, and our air defenses of Canada and the United States, consisting of essential radar stations, interceptor planes, and Army guided missile and antiaircraft battalions.

The counteroffensive forces of NATO consist primarily of the

United States Strategic Air Force and the British Bomber Command with the necessary bases and facilities from which, in the event of war, they could launch an immediate and devastating counterblow. Following the initial blow struck at us, these allied long-range air forces would be making retaliatory attacks deep into enemy territory against vital targets. We must all realize that for years to come it will be necessary to have means of launching counterattacks through the air. We will also need Army forces in reserve not only to protect our bases against the initial shock but to force the enemy to concentrate and thus present a profitable target for our atomic weapons on the battlefield. We will need naval forces to secure our sea lines of communication. This means the long-term maintenance of a going concern overseas and at home.

To restate the essence of our concept—we aim on stopping the initial attack short of victory. We cannot do otherwise and survive. A Soviet engulfment of all or part of Europe would place all free nations in jeopardy. Further, if Europe is allowed to be overrun with the idea of achieving its later liberation, the results would be almost disastrous to the liberators and the liberated alike.

Clearly we must not waver in our concept to halt the initial attack and to be prepared to strike devastating blows by air at the vitals of the enemy. There can be no alternative.

NATO directly supplements the defenses of the United States. Today the protection that we get from our own Armed Forces is increased by the NATO forces of even greater size. Moreover, we and our NATO partners have worked together in constructing a large number of joint bases. We have gained much from NATO and we can expect to gain still more as the NATO program moves forward.

In these days of rising air power it is plain common sense to build our military protection of the United States as far away as it is possible to do so. Therefore, our troops and air groups in Europe are not there merely to defend Europe. They are there primarily to protect the United States. Thus our NATO program is an integral part of our plans for the defense of the United States and not merely for the defense of Europe.

In considering progress made, my mind reverts to the Brussels meeting in December 1950 when NATO member nations requested the United States to designate a Supreme Commander

for Europe and General Eisenhower's appointment was the result. At that time, there were fewer than fifteen NATO divisions in Western Europe adequately trained and equipped for war. National service programs, existing in all European member countries, had trained or partially trained a reservoir of manpower since the end of the war. Unfortunately, equipment was inadequate to convert this pool into effective reserve divisions. In the air the situation was worse. There were fewer than one thousand operational aircraft available in all Western Europe, and many of these were of obsolescent types. On the sea the situation was a bit better, although a tremendous effort would be required to offset the threat of submarine attack.

Although the British, French and United States Zones of Germany contained concentrations of Western air and ground strength, our forces were deployed for occupation and police duties. Air bases were in exposed forward areas, in some cases out in front of the Army units that must protect them. Supply lines for the British and American forces, almost parallel to the front, ran to North German ports instead of to the rear through France and the Low Countries. When one considers that a division in combat consumes about five hundred tons of supplies a day and a jet airplane burns a ton of fuel an hour, it can be seen that logistical support is of major importance.

Today, much improvement has already been made. NATO now has roughly one hundred divisions—both active and reserve —available to the Supreme Allied Commander, Europe. It must be realized, however, that these vary in strength and effectiveness and that they include the forces in Greece and Turkey. They must defend a four thousand mile arc from the Norwegian Arctic to the Caucasus border between Turkey and the Soviet Union. In the air, we have about doubled our strength and soon there will be more than one hundred and twenty air bases available for at least limited use. The logistical situation is being improved slowly. Almost five hundred million dollars has been allocated for the construction of air bases, jet-fuel storage tanks and pipelines, communications systems, naval bases, radar installations and training bases.

In addition to the nearly six billion dollars in arms which the United States has contributed to help build the military forces of NATO since 1949, the European nations have spent more than thirty-five billion of their own on NATO defense. These coun-

tries plan to increase their military expenditures in 1954 and although the increase is expected to be moderate, it follows a more than two-fold rise in expenditures since the Korean action. Currently their expenditures for military hard goods are about $3 billion annually, almost four times as high as before Korea.

NATO emphasis on standarization has produced a number of important results, including a recent agreement on a standardized .30-caliber rifle cartridge.

However we must not permit these short-range successes to jeopardize our long-range program. The cold facts are that when we compare these successes with Soviet offensive power—particularly in Northern Europe and in Central Europe—we still have a long way to go.

Although NATO is far from perfect, nobody has thought up anything better to protect the free nations of the world against the threat of Communist aggression. We recognize that no single nation in the world today can alone meet the Communist threat of world domination without becoming a garrison state, and then we could not be certain that this step alone would meet the ultimate test of war. Therefore we are engaged in collective security arrangements world-wide on a "one-for-all" and "all-for-one" basis, and of these the most highly developed collective security arrangement is NATO. We are in it primarily for the military security of the United States.

Our way of life, our standard of living and our hopes for peace are threatened by the men of the Kremlin who respect power alone. Therefore we must continue, probably for years to come, to support armed forces of greater strength than ever before in our history. Through NATO we must continue to help our friends of the free world to help themselves and to help us in the struggle for survival.

*Progress in Supply Management—*

# The Army Gets More For Its Dollar

**Lieutenant General W. B. Palmer**

THE PROLONGED Cold War, with its expanding alliances, its local wars and revolts, has presented the Army's supply managers with an unprecedented challenge and opportunity.

Always in the past, a wartime feast of unplanned buying has been followed inexorably by a peacetime famine. Inevitably the game of the supply managers was to husband whatever they could of the wartime stocks, in order to sustain a skeleton Army until the next big splurge. The peacetime appropriations were always too small for minimum necessities; there could be no thought of building up any war reserve or even of replacing the stocks from year to year.

The Cold War has changed all that. A large military activity is being supported over a long period of years. Appropriations provide both for annual consumption and for orderly accumulation of war reserves. This is something new in American history—the challenge and the opportunity, never before offered, to organize military supply as an orderly business operation instead of an urgent improvisation.

There are three major "levels" at which supply management occurs—in the wholesale system; in local or post supply; and in the hands of the troops. A few facts will give an idea of the magnitude of supply management's job.

The Army has 73 wholesale depots in the Continental United States. Their stock record cards list over one million different items, adding up to 14 million tons of supplies worth over $17 billion. The CONUS depot system contains 379 million square feet of storage space and employs 125,000 people, of whom 95 percent are civilians. The operating cost of the system last year

*LIEUTENANT GENERAL W. B. PALMER is Assistant Chief of Staff G4, Department of the Army.*

was about $730 million which of course does not include purchase of the goods handled by the system.

In taking up the challenge to our supply management, our first problem was to get control of this enormous inventory. The Army had no way of expressing its inventory in terms of dollars, which is the method business uses to analyze inventory. The Army has always had excellent accounting of items; it can tell what it has of any given article; but there are more than one million different items in the supply system. We had no way of expressing, in workable terms, what part belonged to the Air Force, to Military Assistance programs, to mobilization reserve, and what part was our operating stock. There was no way to lump all those items and talk in broad terms about how much we had, or how it was distributed, or how it compared with our position last year, and our requirements for the coming year.

During Fiscal Year 1954, with the enthusiastic backing of Secretary of the Army Stevens, we have installed financial property accounting of the entire Army-wide warehouse inventory, not merely in the CONUS depots but overseas and in post warehouses.

The financial property report is prepared quarterly. It shows in dollars what we are storing for other agencies and their issue rate, our mobilization reserve position, our excesses, and our operating stocks. We can tell whether we are overstocked, and whether our "on order" position is too high. This is the payoff on inventory control. Our policy on commercial type supplies is to have our inventory in a three months on-hand and six months on-order position. Now we can police our rules, prevent the accumulation of surplus, reduce congestion in our warehouses, eliminate the handling charges for unneeded stocks, and have a clear picture upon which to base budget requirements. Financial property accounting affords G-4 an understandable "look at the books" of the Technical Services; comprehensive supervision of procurement, storage, distribution and disposal actions, using the dollar as a common denominator, is possible for the first time in the Army's history.

A second tool for inventory control is the Stock Fund. The Clothing and Equipage Stock Fund operations show how this type of revolving fund works. It was capitalized in July 1951 at $2.2 billion, of which $200 million was cash working capital

and the remaining $2.0 billion was physical inventory on hand and on order. We knew the inventory was a great deal too high and wanted to get it down to proper operating proportions.

The fund operates by selling its inventory to the posts, camps and stations, receiving reimbursement from the annual appropriations. Primarily by firmly restraining new procurement, the operating inventory in the stock fund will be reduced by July 1954 to $800 million. Much of the inventory reduction has been converted to cash and $285 million already has been returned to the United States Treasury. Ultimately this Stock Fund will be considerably smaller than now.

Stock funding is being extended generally to the Army supply system, and to include the post warehouses and the oversea commands, where we are convinced it will prove as salutary as in the example just given.

Yet another tool for controlling inventories is the Industrial Fund, which affords businesslike control over the operations of our arsenals, rebuild plants, and ports. Take for example Pine Bluff Arsenal, at Pine Bluff, Arkansas. Its industrial fund was started in 1952 with $14 million capitalization. Workloads are programmed at $3.3 million per month. Indirect costs, except depreciation and military pay, are included in the cost of manufacturing a product. One item recently manufactured there for the Air Force was a 500-pound incendiary bomb cluster. Average cost of the item is $237 per unit. We can bill the Air Force with a factual record of costs, while the Arsenal management can lay out orderly procurement of materials, labor and working space, into a smooth assembly-line process.

Industrial funds in logistics were first installed in July 1951 at Picatinny Arsenal, New Jersey, Rocky Mountain Arsenal, Colorado, and Philadelphia Quartermaster Depot, Pennsylvania. In Fiscal Year 1954 eleven activities were added. The plan is to install about 150 more as experience justifies the expansion.

The second major problem confronting Army Supply Management was that our depots were full of stuff we did not need. In the spring of 1953 a careful study led to the estimate that there was about $2 billion worth of excess in our inventory. It consisted of obsolescent big stuff, such as tanks, radar and searchlights; and of thousands of insignificant items that just lay around in bins unnoticed. In the first three quarters of Fiscal Year 1954 we declared $740 million worth of property excess to

Army requirements and disposed of $675 million worth, and we are declaring $100 million worth and disposing of $65 million worth of excesses per month now.

I think the problem that is giving us the longest chase before we catch it is spare parts. In July 1953 there were about 800,000 spare parts carried in our supply system. During Fiscal Year 1954 we are reducing that number to 700,000 items. We are determining what portion of this 700,000 should be carried close to the front lines, what portion can remain in rear echelons, and what portion we do not need at all. By October 1956 we intend to reduce the number of spare parts in the system to about 550,000. The following table will show the very significant progress that has been made in the reduction of spare parts:

*Value of depot stocks on hand and on order (In billions)*

| | | | |
|---|---|---|---|
| 30 June 1952 | $5.2 | 30 June 1954 | $2.9 |
| 30 June 1953 | 4.3 | 30 June 1955 (planned) | 2.1 |

Another way we have reduced both the number of items and the total amount of stuff in our depot system is to have our local consumers buy a vast number of commercial-type items, such as paint, paper clips, fan belts, as needed, from commercial vendors close to the user. Very much simplified procedures have been worked out for purchases amounting to less than $1000. Between 1 July 1952 and 1 July 1953, 1.5 million procurement actions were accomplished in the Army, of which 800,000 were for less than $1000. The cost of a purchase using the standard procurement process is about $45; this cost is reduced to about $7 by the "small purchase" procedure.

We have taken many more items out of the depots by using "open-end" and "on-call" contracts, by which the factory delivers direct to the using post, or the oversea post, as the supplies are needed. In March 1953, about 23,000 items costing $92 million were being procured in this manner. In March 1954 we were buying about 166,000 items costing $200 million in this way.

The sum of all these actions equals control of the inventory and far better use of the dollar. In July 1952 we had 1.5 million items in the wholesale depot system; by July 1953 the figure was 1.3 million; today it is down to 1.0 million; and it will go lower. We now believe that before 1 July 1956 the Army will be able by consolidations in the best-located and most modern installations to vacate 16 of its wholesale depots in the Continental United States, at a saving of at least $30 million per year.

# Korea—One Year Later

EVEN THOUGH the fighting ended just about a year ago, United Nations Forces are still faced with the responsibility of holding back aggression in Korea. Since 27 July 1953, U. S. Eighth Army troops have been engaged in an extensive program of field training, military reconstruction and rehabilitation of civilian communities. (See "Training Vigil in Korea," April 1954 DIGEST.)

American servicemen continue to support orphanages and welfare organizations providing for the care of underprivileged youngsters. From the very beginning, there has been a warm association between Korean children and United States troops.

During their free time, United States forces turn to various forms of relaxation and recreation. The most popular of these are competitive sports. Sightseeing, hunting, fishing and hobby craft groups are widely supported. Many of the military personnel improve their schooling through the United States Armed Force Institute and other special study groups. Chaplains provide regular religious services and personal counseling.

While our forces safeguard the security and welfare of the free people of Korea, there are available unlimited facilities for personal welfare and morale in that war-torn land.

*United States infantrymen leap from an armored personnel carrier during training exercises. Below, British infantrymen advance on an "objective."*

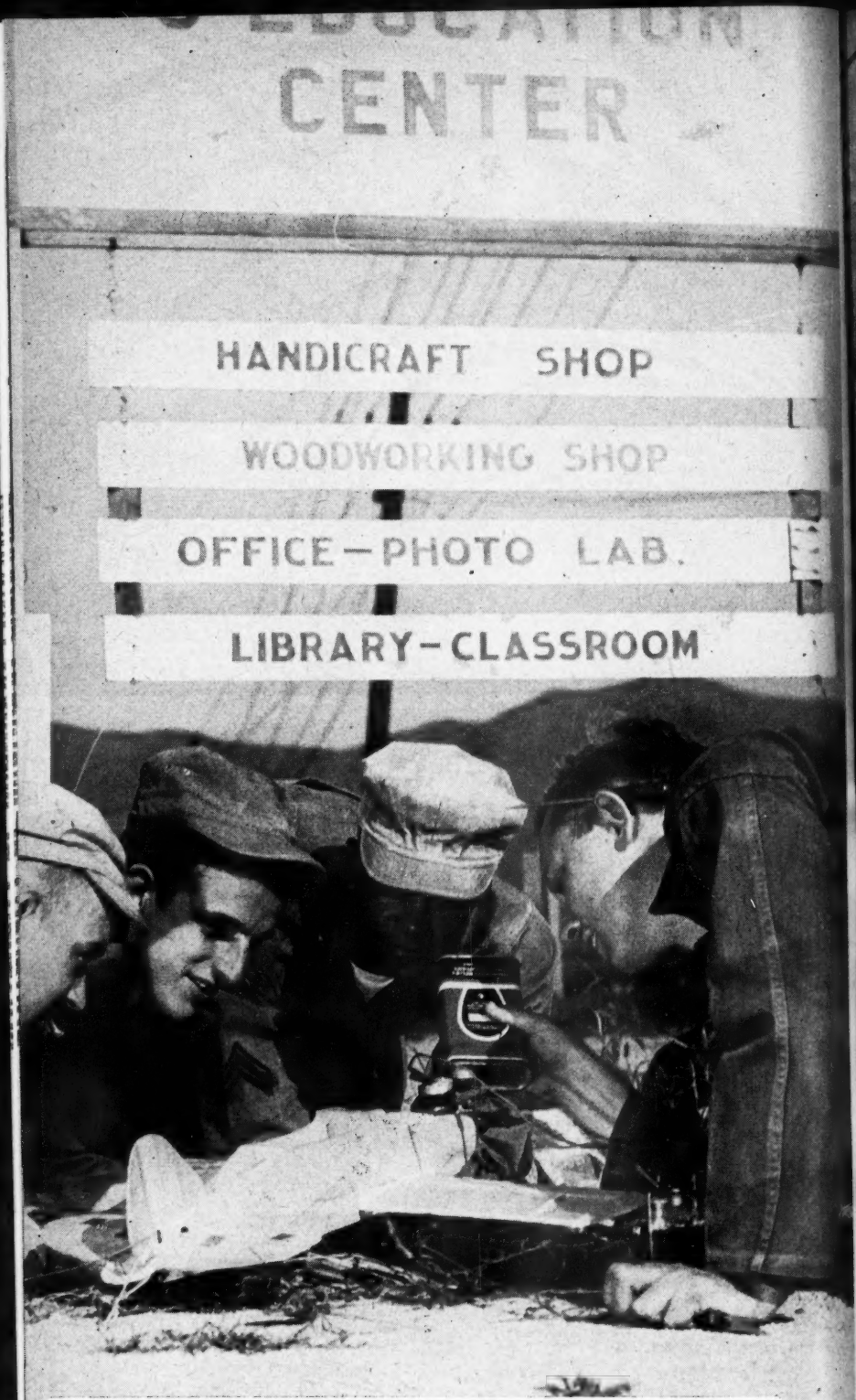
U. S. Army Photographs

*Members of an armored unit attend a class on the operation of the M-47 tank. Below, an American officer explains the functioning of a 40-mm. gun to Republic of Korea soldiers.* U. S. Army Photographs

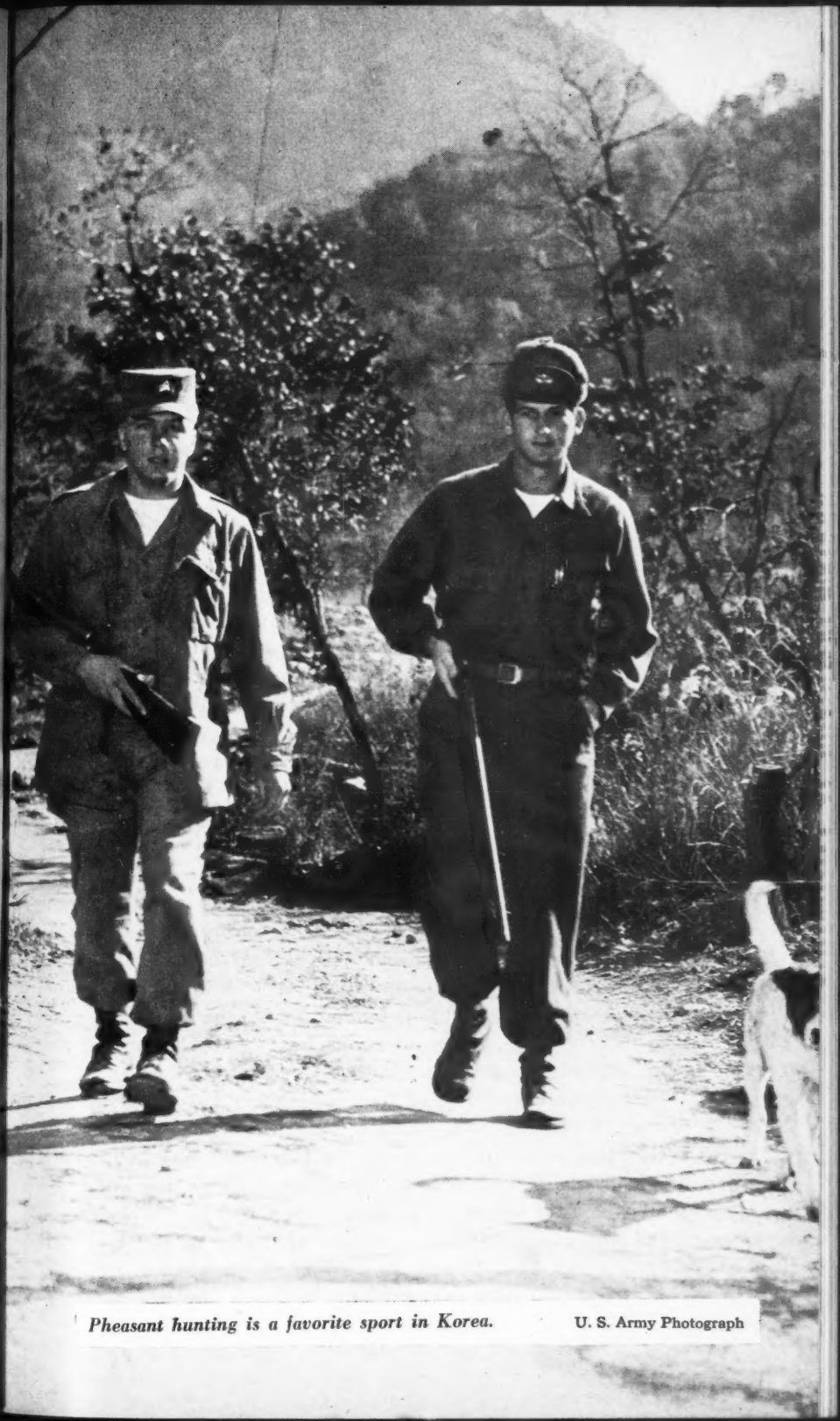
*Korean children climb aboard for a closer look at an M-41 tank. Below, native dancers and musicians entertain United Nations military personnel at an improvised outdoor theater.*

U. S. Army Photographs

*Construction work continues unremittingly. The Quonset hut above will accommodate troops in training. Below, Army personnel co-operate in building a church to be used by Korean civilians.* U. S. Army Photographs




*Off-duty time is often devoted to favorite crafts and hobbies. Here soldiers work on a model plane.* **U. S. Army Photograph**



*Pheasant hunting is a favorite sport in Korea.* U. S. Army Photograph

# Airborne Operations

**Major General Albert Pierson**

"WHERE is the prince who can afford so to cover his country with troops for its defense, as that ten thousand men, descending from the clouds might not, in many places, do an infinite deal of mischief before a force could be brought together to repel them."

This prophetic statement was made by Benjamin Franklin in 1784 at a time when the first smoke-filled balloons had given scant promise of the future of aircraft. A contemporary of Franklin, one Francois Blanchard, is generally credited with the first parachute jump. The parachute and the airship, two essentials of airborne warfare, were extremely limited when the brilliant mind of Franklin conceived the principle of transcending obstacles of distance, terrain barriers and enemy dispositions to effect a surprise concentration of force at a critical point.

The visionary sketches of Leonardo da Vinci centuries prior to Franklin's time contain drawings of parachutes and aircraft, and since da Vinci served as an officer under Cesare Borgia one may well wonder what ideas were in the brain of this genius. Da Vinci was certainly familiar with the myths of Bellerophon and his winged horse Pegasus who bore him into battle across oceans, mountains and the defended boundaries of hostile countries. The British airborne troops have as their emblem the silhouette of this warrior mounted on his winged steed.

Thus the air mobility of ground forces is not a new idea. It was given practical expression by one who signed the Declaration of Independence over a century before the Wright Brothers flew at Kitty Hawk. In basic terms, an airborne operation is a commitment of forces by air transportation. The lift capability, speed and independence of surface obstacles of the transport

*MAJOR GENERAL ALBERT PIERSON, USA, is Director, Joint Airborne Troop Board, Fort Bragg, North Carolina.*

aircraft permit a surprise concentration at selected objectives beyond the reach of other land forces. The development of airborne techniques has permitted the assault delivery of mass forces capable of organized combat within moments of the passage of aircraft over the objective. Individuals can engage an enemy in a matter of minutes after jumping from an aircraft.

The stalemate of position warfare stimulated what was probably the first staff study devoted to an airborne operation. This study was directed in October 1918 by General Pershing after Brigadier General "Billy" Mitchell recommended that a division be dropped by parachute from bombers behind the German lines to attack the fortress of Metz from the rear. This planning was cancelled when the Armistice ended combat operations. It was left for the next generation to develop airborne warfare in World War II.

The earliest extensive military experimentation in this field was undertaken by the Russians in pre-World War II days, which may be surprising in view of the limited nature of their airborne operations against the Germans. The German air force under Goering organized and trained parachute and glider units for ground combat. These airborne forces were employed in conjunction with the surface campaign of 1940 against the Low Countries with amazing success. General Mitchell's concept of airborne assault on a fortress was utilized by the Germans in the capture of Eben Emael, where parachutists and gliders not only landed within the ring of fortifications, but on the very roofs of underground strongholds. This fortress of modern design and armament was speedily reduced by a limited force of lightly armed men, whose victory was exploited by the advance of armor against the Allies' vulnerable flank.

It must be said for United States forces however, that even before this time considerable thought was being given to the development of an airborne arm.

How did airborne actually come into being in the United States Armed Forces? It is interesting to note that in 1939 there was a discussion involving the Chief of Engineers, the Chief of the Air Corps and the Chief of Infantry as to who should have the responsibility for the newly proposed parachute troops. In January 1940 the Chief of Infantry was instructed by the War Department to study the feasibility of airborne infantry and the practicality of transportation by air of all types of ground

troops and equipment included in the infantry division. Five months later a test platoon of parachutists, under the command of Lieutenant (later Colonel) William T. Ryder, was organized as an experimental agency of The Infantry School at Fort Benning, Georgia. Riggers and parachutes were procured from the Air Corps at Wright Field, and an eight-week training program was initiated. The first parachute jump by personnel of the test platoon was made in August 1940 from a B-18 bomber.

Airborne development and expansion was given impetus by the German invasion of Crete in May 1941. Here for the first time in history, airborne forces were employed in a corps-size operation dependent on air lines of communication and utilizing tactical aviation in lieu of armor and heavy artillery. The fighting was virtually over when a German contingent from Greece and Italian forces from the Dodecanese Islands arrived by surface vessels and joined the airborne force. An earlier German seaborne contingent had been destroyed by British naval units. In this operation the capture of an airfield, Maleme, by parachutists was exploited by the air landing of a mountain division, which joined forces with the glider and parachute assault force. German tactical air forces provided close support throughout the operation. In less than two weeks the island was declared free of organized resistance.

In 1942 the United States Army activated the Airborne Command, several parachute regiments and battalions, and two airborne divisions, the 82d, under Major General Matthew B. Ridgway, and the 101st, under Major General William C. Lee. The Army Air Corps had previously experimented with both gliders and the air landing of ground troops, and during 1941 a company of the 501st Parachute Infantry and the 550th Infantry Airborne Battalion participated in an exercise wherein an airfield was seized by parachute assault and air-landed units were flown in to exploit the assault. Such early exercises were supported by air transport echelons of the Air Service Command. The Troop Carrier Command was established on 20 June 1942, and the Army Air Forces moved out on a troop carrier expansion and development program concurrent with the ground forces' airborne program. World War II saw the activation of five airborne divisions.

During 1942 and 1943 air and ground officers applied themselves to insure the training that permitted the later commit-

ment of airborne forces in major operations. As a result of these efforts, the proficiency demanded of parachute, air-landed, and troop carrier units working in conjunction was attained.

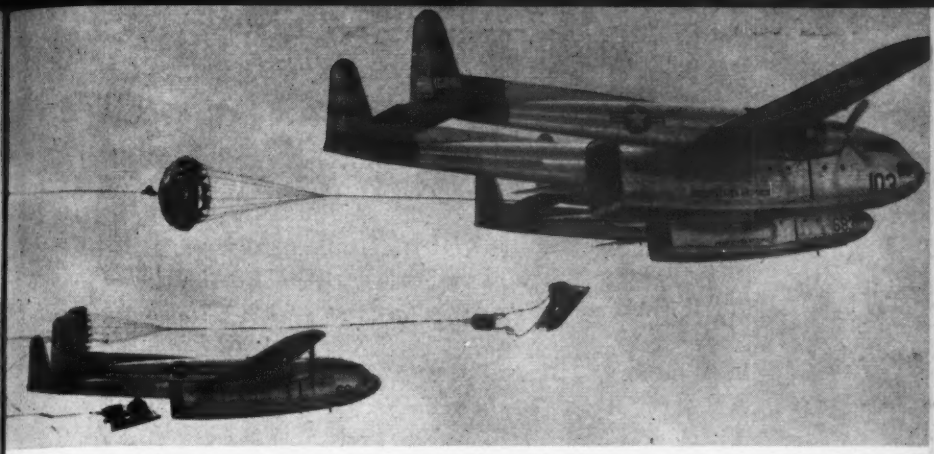
The first American airborne assault in combat was executed in the North African campaign at Youk Les Bains, 14 November 1942, by the 2d Battalion, 503d Parachute Infantry Regiment (later redesignated the 509th Battalion) and the 60th Troop Carrier Group of the 51st Troop Carrier Wing. Subsequent experience in airborne operations led to the establishment of the First Allied Airborne Army, under command of Lieutenant General Lewis H. Brereton, U.S. Air Corps.

The largest airborne assault of World War II was executed by the First Allied Airborne Army, which contained formations of both air and ground units. This command conducted the operation in Holland in September 1944. Troop carrier components included the IX U.S. Troop Carrier Command and the 38th and 46th Royal Air Force Groups. Ground units were organized under the 1st British Airborne Corps. Those committed included the 82d and 101st U.S. Airborne Divisions, the 1st British Airborne Division and the Polish Parachute Brigade. Aircraft flew 5582 sorties to deliver 2557 gliders, and 34,876 glider-borne and parachute troops and their equipment.

The last American airborne assault of the war occurred on 23 June 1945 when the Gypsy Task Force, composed of parachute and glider elements of the 11th Airborne Division under Major General Joseph M. Swing, was dropped at Aparri, Philippine Islands, by the 54th Troop Carrier Wing.

A study of historical accounts leads to the conclusion that airborne operations played a significant part in the over-all campaigns in World War II. There is no doubt that airborne units

*Heavy equipment is loaded aboard a C-124 for transport to an airhead behind "enemy" lines.* U. S. Army Photograph



*Items of heavy equipment are dropped from C-119 aircraft to troops on maneuvers.* U. S. Army Photograph

achieved an esprit de corps not often equalled by other units.

As envisaged today, an airborne operation is one involving the movement and delivery by air, into an objective area, of combat forces and their logistical support for execution of a tactical or a strategic mission. The means employed will be any combination of airborne units, air-transportable units, and types of aircraft.

There is normally an assault phase executed by airborne units and troop carrier units. An objective area is seized and an airhead is established. This may then be followed by consolidation and exploitation phases accomplished by air-landed or parachuted reinforcements.

Field army type ground units which are air transportable can participate in airborne operations. An airborne corps in an operation may consist of one airborne division and two or more infantry divisions, plus various other type field army units.

Four primary types of airborne operations are conceived. The *early link-up type* involves link-up within a limited period by airborne forces with friendly surface troops following an airborne assault, usually executed as a part of a larger operation. In the *independent type* operation an airhead is established by airborne assault, and additional forces are moved in by air for further operations; forces in the objective area will be primarily dependent on air lines of communication for an extensive period. The *raid type* operation involves the delivery of a raiding force by air, withdrawal being made either by air or surface. The *special type* includes those operations not properly belonging to the others. The classification of an operation may be mainly a question of emphasis, as certain airborne missions may possess the characteristics of several types.

*Paratroopers of the 187th Airborne Regimental Combat Team descend in Korea.* U. S. Army Photograph

Airborne operations require not only the joint training of air and ground forces, but the development of doctrines, procedures and equipment suitable to these joint operations.

Fort Bragg, North Carolina, is the home of the Joint Airborne Troop Board and the Joint Air Transportation Board. These have as their responsibilities the development of joint doctrines and procedures, the evaluation of joint tactics and techniques, and the evaluation of joint training and equipment in regard to airborne and air transportation matters. Some of these activities are conducted in conjunction with other agencies. The Boards are composed of senior Army, Navy, Marine Corps and Air Force officers experienced in airborne, troop carrier and air transportation matters.

Headquarters of the XVIII Airborne Corps is also located at Fort Bragg. Two divisions—the 82d Airborne Division at Fort Bragg and the 11th Airborne Division at Fort Campbell, Kentucky—are assigned to the Corps. The Corps and the Divisions

are organized on lines similar to that of other Corps and of Infantry Divisions, with infantry, artillery, engineers and service elements of ordnance, medical, signal, transportation and quartermaster units and other service personnel. The major difference between these troops and infantry divisions lies in their capability of entering into combat by airlanding and parachute as well as by surface means.

Ground combat training of airborne units is not too much different from that of other troops. Physical fitness receives a great deal of stress. The individual parachutist is given a three-week jump training course at Fort Benning, Fort Bragg or Fort Campbell, and is declared qualified after a minimum of five jumps, including one with full combat equipment. The new parachutists, ranging in grade from private to general, are usually sent direct to airborne units.

The Eighteenth Air Force, with headquarters at Greenville, South Carolina, provides the troop carrier support required by these airborne units.

The C-119 transport aircraft is the workhorse of the troop carrier fleet. It can transport a load of more than sixty combat-equipped soldiers for airlanding, or about forty parachutists—and their equipment. It may deliver by parachute individual items weighing as much as a medium-sized bulldozer.

World War II saw airborne troops go into combat with only light infantry weapons and the 75-mm. pack howitzer artillery. This howitzer was either parachuted disassembled or brought in by glider. Heavy drop techniques today have been developed to the stage where the airborne soldier can bring in with him his medium artillery. The C-119 has the capability of dropping the men and the equipment.

The monorail, a trolley arrangement in the center of the aircraft, permits the ejection of parachute-equipped bundles of supplies and light weapons from a forward hatch as parachutists are jumping from doors in the sides or rear of the plane. Bulk supplies and heavy items of equipment are loaded aboard aircraft through large doors, which in the case of the C-119 are removed to permit the ejection of these loads in flight. In other aircraft, loads are ejected through similar "clam-shell" doors or through large floor hatches.

When parachutists jump from aircraft they first "hook-up," or attach a snap-fastener to an anchor-line running the length of

*Soldiers deplane from a C-124 during Exercise Flash Burn. This aircraft can transport two hundred combat equipped infantrymen.*

U. S. Army Photograph

the passenger compartment. A static line to the snap-fastener pulls away the covering in which the parachute is packed, and causes the parachute canopy to deploy automatically when the parachutist jumps. A reserve parachute worn on the chest provides an added safety factor in the rare instances of malfunctions.

During joint training, Army airborne units take to the air in Air Force troop carrier aircraft. In a tactical exercise the first C-119 carries an Air Force combat control team and an Army fieldmaster team. This plane precedes the aircraft formation to the drop zones where the Army and Air Force personnel parachute to the ground and set up communications and other equipment. The main airborne force formation follows.

Navigational computations are made. Four minutes from the drop point each first pilot warns the Army jumpmaster aboard his plane. The usual signal is by a red warning light. The Army jumpmaster sees that all men stand up, hook-up, and check their equipment. Two lines of parachutists, called "sticks," prepare to follow the jumpmaster and the other stick-leader who are at the door ready to jump. At the proper time and in the proper sequence, the pilot releases the equipment bundles on the monorail, switches on a green light, and the parachutists leap out. Less than twenty seconds later the C-119 is empty of paratroopers and their equipment.

The C-119's with the rear clamshell doors removed, followed with heavy bulk loads. When the plane is over the drop zone, a small extraction parachute is released. This in turn pulls out the loaded platform carrying the heavy equipment. The cluster of large parachutes blossoms out and the equipment floats down.

In a matter of seconds, the aircraft have dropped the assault force and its equipment and assault supplies and are on their return trip. Soon other aircraft formations fly over the drop zone dropping reinforcements, supplies or additional equipment. Such units as artillery and combat engineers proceed with their specific combat missions in support of the airborne infantry. Other engineers may prepare a field for air landing. Signal units set up communications, and ordnance, quartermaster, chemical, transportation and medical personnel establish their installations. The Air Force combat control party prepares to take over the field to direct incoming aircraft in landing and parking. The airhead is established.

Assault transport now in production are an outgrowth of a

requirement to replace the World War II glider. Powered aircraft capable, when loaded, of short take-offs and landings on unprepared but selected airfields, will permit the more rapid establishment of the airhead.

Air-landing facilities and proper aircraft enhance the mobility of our Armed Forces. It is contemplated that infantry divisions will be made air transportable and receive training in air movement. Supply of troops in the combat zone by air drop and air-landing in Korea indicated a broadening future for air transport support of ground combat.

As progress is made in developing lighter equipment, more and more logistical problems will be solved by air transport. Helicopters have been employed in Korea for the movement of troops and supplies. The capability of the helicopter to hover a few feet above the ground and to land and take off in areas which may not much exceed the configuration of the aircraft, will permit increased mobility. Small units may move about with growing independence of surface routes for the delivery of their supplies and the movement of their supporting weapons. Barriers once requiring significant effort or costly sacrifice may be negotiated by troops who land in selected areas a relatively short time after take-off. Air transport may permit a reduction of stockages in forward depots; sometimes supplies will be flown directly from the production facility to the oversea area.

Several airborne exercises have been conducted recently to develop and test airborne techniques and planning factors both for combat and logistical purposes. These exercises included dropping of heavy equipment, construction of landing facilities, co-ordination of joint problems involving the Army and the Air Force, testing the adequacy of operating procedures and mass air moves, including evacuation of troops and supplies.

Airborne and air transportable ground troops, combat-ready with proper and adequate air transport, provide a key to the problem presented by President Eisenhower in his State of the Union message when he said, "Our Armed Forces must regain maximum mobility of action. Our strategic reserves must be centrally placed and readily deployable to meet sudden aggression against ourselves and our allies . . . Our defense must rest on trained manpower and its most economical and mobile use."

# A SURVEY OF OUR READERS

ARMY INFORMATION DIGEST, official monthly magazine of the Department of the Army, is published by the Chief of Information. Its aim is to provide timely and authoritative information on the policies, plans and operations, including technical developments, of the Army and its reserve components, and of the Department of Defense and the other services, insofar as their activities pertain to or include the Army.

With a distribution of 40,000 copies each month, the DIGEST has close to a half million readers of all grades, lengths and types of service, degrees of education, and reading and military interests, in units and installations all over the world.

The extent to which the magazine serves their needs—and yours—is the ultimate measure of its success.

It is the primary ambition of the editorial staff to be of assistance to the greatest possible number of readers. To provide the data that will enable us to make the DIGEST of ever increasing value and interest, will you complete and forward the form which starts on the next page.

This 4-page center section can be removed without affecting the rest of the magazine.

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1. Where are you stationed?

2. Your grade? Arm or Service? Duty Assignment?

3. Years of Army service? RA? USAR? NG? AUS?

**FOR CIVILIAN READERS**

4. Occupation? Location?

5. Years of military service?

6. Army? Navy? Marine Corps?

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7. Do you see ARMY INFORMATION DIGEST
   (a) regularly?..... .....(b) occasionally?.....

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| Plans | ..... | ..... | ..... |
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| International Affairs | ..... | ..... | ..... |
| Other Services | ..... | ..... | ..... |

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**COMMANDERS WHO WISH TO SURVEY THEIR COMM**

10. Which *type* of article listed in question 9 do you find most interesting? Give first, second and third choices.

(1)..... (2)..... (3).....

b. In what way?

11. a. Which *type* of article listed in question 9 do you find most useful professionally?

(1)..... (2)..... (3).....

12. Is there any particular type of material that you would like to see included from the standpoint of
(a) professional value —

(b) personal interest —

13. What can be done to make the magazine as a whole
(a) more useful to you?

(b) more interesting?

14. Please make any other comments or suggestions you desire, using additional paper if necessary.

This form need not be signed unless you wish. Please complete it, remove it from this issue and mail it to:

The Editor
Army Information Digest
Fort Slocum, New York

# What's In a Name

**Major General John A. Klein**

FOR YEARS the Army has honored individuals with distinguished military records by naming camps, forts, arsenals and even vessels after them. Walter Reed Army Medical Center, Fort Benning, Fort Leavenworth, Fort Sill and Fort Sam Houston are but a few installations which recall the deeds of famous military figures.

While established by tradition, the procedures governing memorialization were not formulated until the close of World War II, when General of the Army Dwight D. Eisenhower, then Chief of Staff, directed a study of the problem. As a result of this study, the Department of the Army Memorialization Board was established in 1946.

The Board is a permanent institution whose membership comprises the Assistant Chief of Staff G1; Assistant Chief of Staff G3; Assistant Chief of Staff G4; and The Adjutant General. G1 is President of the Board and The Adjutant General is Recorder. Besides formulating Department of the Army policy on memorialization, the Board also applies it.

At first thought, it might appear a simple matter to find a distinguished name for a camp, fort or arsenal. Actually existing policies, developed sometimes by advance recognition of problems to be faced, sometimes by rule-of-thumb analysis of a situation, are in a constant state of modification.

One of the few policies which has not been modified is the rule that active units of the Army will not be named for individuals, but will adhere to a firm numerical designation patern. Still another fundamental policy, relatively simple and clear-cut, provides that memorialization of a living person or of an individual, which might give rise to controversy or unfavorable public reaction is not considered.

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*MAJOR GENERAL JOHN A. KLEIN, USA, is The Adjutant General of the Army.*

Five major categories of persons eligible for memorialization have been established, based on the degree of heroism or accomplishment. These categories, as set forth in AR 15-190, are:

*Category I*—A national hero of absolute preeminence by virtue of high position. Example: General of the Armies John J. Pershing.

*Category II*—An individual who held a position of high and extensive responsibility (Army or above) and whose death was a result of battle wounds. Example: Lieutenant General Lesley J. McNair, killed in Europe.

*Category III*—An individual who held a position of high and extensive responsibility and whose death was not a result of battle wounds. Example: General George S. Patton, killed in a motor accident.

*Category IV*—An individual who performed an act of heroism or who held a position of high responsibility and whose death was a result of battle wounds. Example: Medal of Honor and Distinguished Service Cross winners, many of whose names have been given to ships of the Transportation Corps.

*Category V*—An individual who performed an act of heroism or who held a position of high responsibility and whose death was not a result of battle wounds. Example: Walter Reed, pioneer in Army medical research.

Corresponding to these categories are gradations of appropriate types of memorialization, ranging from the naming of an entire post or military reservation to that of a street, building, or the like, of an Army installation.

The executive function of the Board, however, does not extend into every case of memorialization Army-wide. For example, during the summer of 1953 Major General Guy S. Meloy, Jr., then Commanding General, The Infantry Center, Fort Benning, Georgia, conducted ceremonies during which various streets and buildings of the post were named in honor of World War II heroes. Such action is discretionary with installation commanders without reference to the Department of the Army, although in general the Department is cognizant of the event. Temporary installations such as camps located in oversea areas may be named by area commanders and the Department so informed.

Similarly, recommendations are sometimes received from Members of Congress, state or municipal officials, or private citizens regarding the naming of such activities as local Army

Reserve armories. While these matters are the responsibility of the commander of the Army Area concerned, the Department stands ready to provide background information or guidance if it is desired.

Curiously, many famous names have not yet been memorialized. Though recognizing that they deserve such honor, the Board feels that no suitable installations have been found for them. In every instance, interacting factors must be considered. Assume, for example, that a new Quartermaster Depot is being established, or that one in existence has merely a geographical name which could be readily changed. Would it be appropriate to name such an activity for General Patton, the dashing cavalry and armor commander? Obviously not. Again, has a given post been renamed to a point where confusion might arise? The present Fort McNair, for instance, has in its history been variously known as Fort Jefferson, Washington Barracks, Washington Arsenal, United States Barracks, Fort Humphreys, the Army War College, and the National War College.

As another example, it would scarcely be appropriate to name a post in Alaska for a general whose entire combat career was in the European Theater of Operations, especially since quite possibly another person eligible for memorialization may have achieved his principal distinction in Alaska.

Still another factor to be considered is the impact on the public. The Presidio of San Francisco is a politico-geographic designation, established before the United States existed as a republic. Nevertheless, it is a name of long and significant historical tradition, and it is reasonable to suppose that the people of California would look askance at an arbitrary redesignation.

Of even more personal consideration in some cases are the feelings of families, and particularly of next of kin. Assume that Department of the Army has determined that a completely appropriate means of memorializing the individual has been found, but the subject's widow registers violent objections. Are her feelings to be overridden? Or should she have been consulted in the first place?

Even the determination of the size of installations and vessels to be named gives rise to controversy. When the Board was established, there was a wider range of types of Army vessels to consider than at present, since the Army was then operating its own transports. Though these vessels were in general sizeable

craft, there were and are many others, such as tugs and barges, which might not be appropriate for memorialization.

To handle necessary research and preliminary study, the Board maintains a standing Ad Hoc Committee, composed of a representative from the office of each Board member. Among their activities, these individuals assemble background information from Adjutant General files, the National Archives, and the Office of the Chief of Military History; they request legal interpretations from The Judge Advocate General; they carry on liaison with Members of Congress from the states in which installations are to be named or re-named; and they ascertain the wishes of next of kin. Generally they study each problem and compile pertinent facts as a basis for their recommendation to the Board.

Although the Department of the Army is naturally concerned only with the memorialization of Army personnel, other services and at times the Department of Defense itself must be consulted. At the time of the re-naming of Fort McNair, for instance, a question of this nature arose. The National War College (then the designation of the activity occupying the installation) comprised not only the Army War College, but the Army-Navy Staff College. Would it be proper for the Army to redesignate the installation without the approval of then Secretary of Defense James Forrestal? On the other hand, the actual site did belong to the Army. The conclusion was that no impediment existed to re-naming the site, with the result that the National War College—an all-service activity—is located at Fort McNair, an Army installation.

The naming of Camp Drum, New York, illustrates the procedures followed by the Memorialization Board. After the death of Lieutenant General Hugh A. Drum, a recommendation was received in the Department of the Army that Pine Camp, New York, be renamed in his honor. By virtue of the positions of high responsibility which he held, General Drum was among those in Category III—eligible for memorialization at the installation level. Pine Camp was an inactive station, but was extensively used at the time by reserve components for training. Although the name "Pine Camp" was an old one, it had no historical significance.

Routine research was performed by the Ad Hoc Committee. The history of Pine Camp was reviewed; background informa-

tion concerning General Drum was obtained and consolidated; and the views of the Governor of New York and other public officials were ascertained. A point of possible confusion was raised because of the former existence of a Fort Drum in the Philippine Islands, named in 1909 in honor of Brigadier General Richard C. Drum, who served with distinction during the Mexican and Civil Wars. Since the Philippine Fort Drum was inactive, and in any case no longer under United States jurisdiction, this consideration was dismissed.

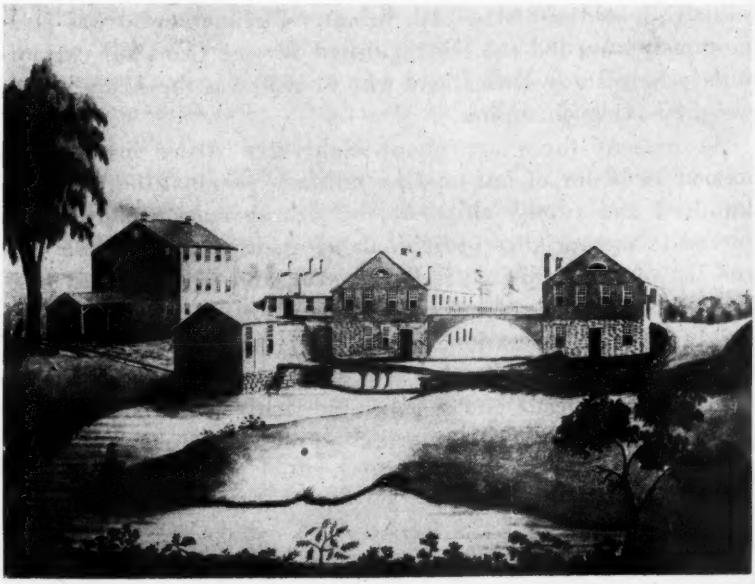
When all information was in readiness, the Board was convened by its President. The members concurred in the proposal and their conclusion was reported to the Office of the Chief of Staff who referred the recommendation to the Secretary of the Army. The Secretary thereupon directed that Department of the Army General Orders be published announcing the action.

While the major efforts of the Board have involved the renaming of installations and ships, other means of memorialization such as scholarships, trophies and the like, have not been overlooked. For example, the trophy awarded each year to the outstanding contestant in the Annual Army Boxing Championship Tournaments, whose sportsmanship, courage, skill and physical endurance exemplify the finest attributes of the American soldier, has been named in honor of Corporal Levi Jackson, Jr., a soldier of the 24th Infantry Regiment who was posthumously awarded the Distinguished Service Cross for extraordinary heroism in Korea, and who in 1950 was the Army heavyweight boxing champion.

At present there are about eighty-five Army installations named in honor of outstanding military personalities, and one hundred and twenty ships of the Transportation Corps have served to memorialize individuals of distinguished service. But the list of those eligible is longer still, and studded with celebrated names. The Army Memorialization Board, necessarily moving with deliberation, is steadily achieving its mission of appropriate memorialization for those men of the Army who have by their deeds and sacrifices so richly deserved all honor that can be done their memories.

*The Springfield Armory Administration Building is a contemporary landmark. Below, an early print reveals the first Armory buildings as they appeared in 1830.*

U. S. Army Photographs



# Springfield Armory—Pioneer In Small Arms

**Chris L. Dvarecka**

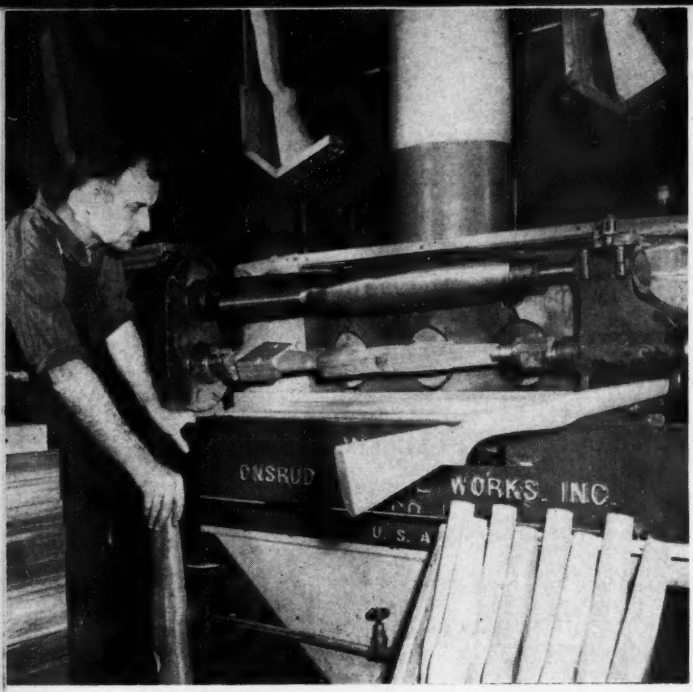
SOLDIERS at distant duty stations and citizens everywhere have a vital stake in the work of the Springfield Armory which this year observes its one hundred and sixtieth year as the pioneer gunsmith of the Army. Both the Armory and the craftsmen of Springfield, Massachusetts, have contributed much to the development of small arms standardization in America, and thereby to the success of American armies in the field.

Rise of the Ordnance Corps Armory to its preeminent position as a small arms center began during the Revolutionary War. At that time, many apparently decisive battles had to be cut off at seemingly victorious moments due to lack of ammunition. The colonists brought their own guns into battle and these, of various makes and of different calibers, required tailor-made ammunition. As a result, the Continentals often went into battle equipped for only a short fight. In one classic instance, the battle of Bunker Hill was lost only after the defenders ran out of powder and ball and were forced to abandon their position.

To prevent a repetition of this, General George Washington urged the adoption of a standardized rifle for the entire Continental Army. The only question remaining was, where should the gun be made?

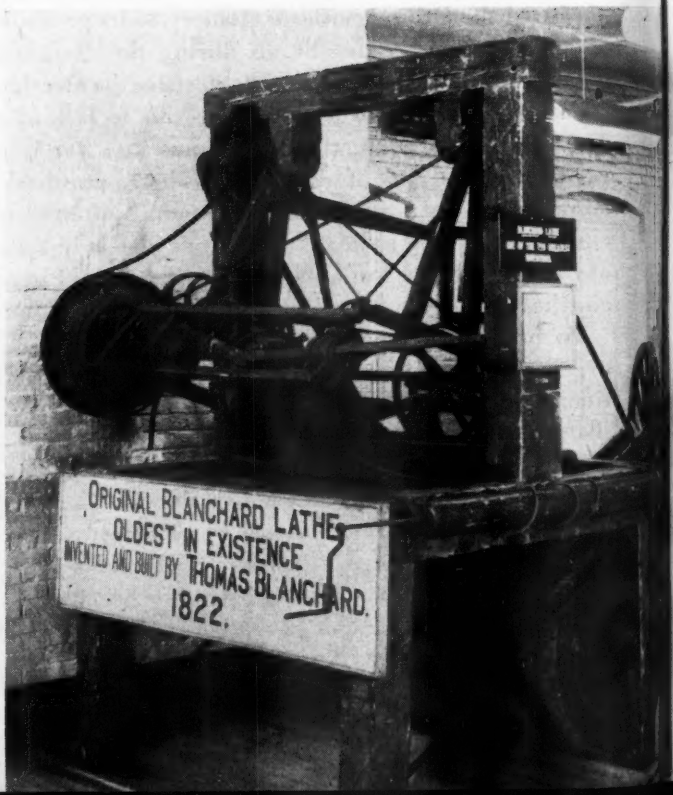
Springfield was chosen for a variety of reasons. It was well located geographically, far enough inland to prevent raids from the sea and supplied with ample water power so necessary in any type of manufacturing. But in the final analysis, Springfield was chosen as the site of a National Armory because of the presence of a considerable number of skilled gunsmiths, blacksmiths and

*CHRIS L. DVARECKA is Public Information Officer, Springfield Armory, Springfield, Massachusetts.*




*Gun stocks are turned on a modern lathe whose basic design was first developed in Armory shops.*

**U. S. Army Photograph**




*Considered one of the ten greatest inventions of American industry, the original Blanchard lathe is displayed at the Armory.*

**U. S. Army Photograph**

other artisans. Springfield was then virtually the western outpost of New England civilization and since a gun was an essential item of equipment for settlers moving westward, gunsmiths found a flourishing trade locally.

The availability of such a great number of artisans prompted General Henry Knox, Washington's most experienced Artillery officer, to recommend Springfield as one of the sites for the location of a "Laboratory" and depot. Early in 1777, buildings were rented for this purpose. A few years later the works were removed to the high ground which is now Armory Square. Here barracks, shops and storehouses as well as a powder magazine were constructed. A powder mill—forerunner of the present Water Shops—was built on the banks of the Mill River.

Following the Revolutionary War, all manufacture and repair work was stopped, but Springfield was retained as a storage depot for the New England area. Washington visited the city shortly after his inauguration in 1789 and, convinced of its potentialities, recommended the establishment of a National Armory there. The Third Congress authorized the Armory on 2 April 1794, and that year has always been considered as its official date of inception.

Since then the Armory and the community have been mutually interdependent. The Armory attracted additional arms industries to the area; the supply of competent gunsmiths in turn has been an important factor in enabling the Armory to continue its activity. Other small arms armories such as Harper's Ferry and Augusta have since gone out of existence as such.

Today the installation is the only manufacturing arsenal in the United States that calls itself an Armory. Originally the terms "armory" and "arsenal" were synonomous. The modern tendency, however, is to differentiate by reserving "arsenal" for manufacturing operations and "armory" for such varied activities as storage of arms, drilling of troops and arms fabrication. The Springfield Armory was so designated from the very beginning and because of the long historical association, the name has remained unchanged.

The first permanent building in Armory Square was a brick storehouse known as the West Arsenal. Built in 1807, it is still standing and today houses the Officers' Club and conference halls. The Middle Arsenal, also on the State Street side of Armory Square, was built in 1830 and is now occupied by an engineering

group. The Main Arsenal, which appears on the City Seal of Springfield, is located on the west side of the Armory quadrangle and is currently being used as a storehouse. Three plants were located on Mill River in 1817. The present Water Shops built in 1902 are on the site of the former "Upper Mill."

Reflecting the successive epochs in small arms evolution, Springfield Armory over the years has produced six principal types of weapons—the flintlock, percussion with smooth bore, percussion with rifled bore, breech loading, bolt action, and the semi-automatic.

The French Charleville Musket was the first manufactured at the Armory in 1795; the percussion type followed in 1842; the first rifle musket was made in 1855; and the first breech loader was introduced in 1866. In 1892 the first bolt action rifle was put into production; this was followed by the Springfield rifle in 1903. After World War I, extensive development work was begun on the semi-automatic rifle, and the first Garand was issued in 1937.

In 1795, with forty people employed, a total of 245 Charleville muskets was produced at the Armory; in 1864, some 276,000 rifles were made there. In World War I, a peak daily production of 1500 was reached with 5381 employees.

The earliest role of the Springfield Armory was that of arms storage, but later manufacturing became the major activity. Designs were taken from outside sources, as in the case of the French Charleville. Because of the simplicity of these early models, many were adopted almost intact.

During the first half of the Nineteenth Century, weapons designed by civilian arms inventors were adopted and modified, when necessary, to meet military requirements. The American arms industry, at the same time, was using its talents in developing weapons for civilian use. Even today there is no civilian company in the United States devoted primarily to production of military arms. The existing civilian arms industry however does have the capability of making military weapons efficiently and effectively. Given the time to tool up, it has produced, and will continue to be capable of supplying, arms for the military.

Before a gun is finally adopted by the Army and placed in production by the Ordnance Corps, it undergoes exhaustive tests during a series of elimination firings. The judges are selected from men who actually do the test firing—infantrymen. Their

*Special equipment is used to straighten gun barrels.* U. S. Army Photograph

judgment is the final word on which gun will be adopted by Department of the Army.

In its continuing search for better materiel, the Ordnance Corps is not content to depend upon American-designed weapons solely. Entries are encouraged from all parts of the world and from all classifications of designers. Only the best available are submitted for comparison. The final choice has to beat the field in order to be adopted as the basic Army weapon.

The M1 Garand, invented and designed by the Armory's own John C. Garand, provides an excellent example of how a gun is finally chosen. The procedure followed has since been repeated in every instance where a new type gun has been selected.

Although the Garand was finally adopted in 1936 by the Army, tests to determine its capabilities were begun back in 1929. At that time, the Garand was entered into competitive firing and material breakdown with the Brauning, designed by Carl August Brauning of Holland; the Colt, designed by J. Edmund Browning; a Czechoslovakian gun designed by Vaclav Holek of Bren

gun fame; the Thompson Automatic Rifle; the Pedersen, a .276 caliber rifle; and the Rheinmetall designed by Carl Heinemann of Switzerland.

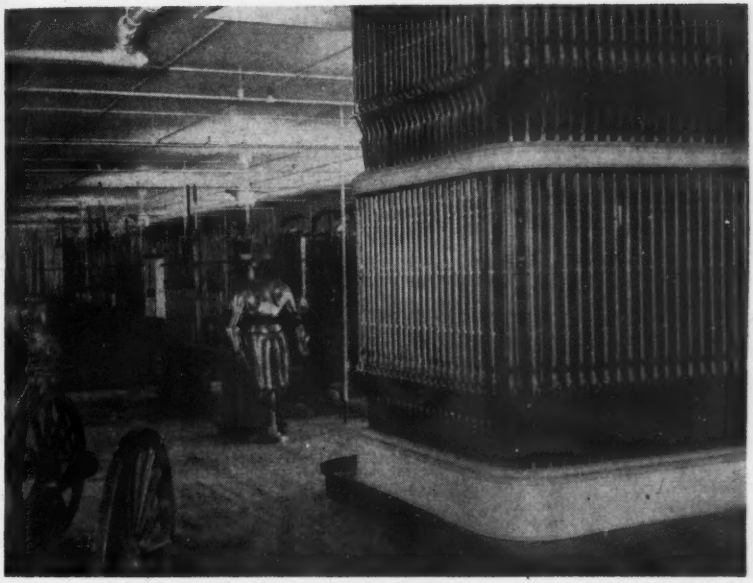
First tests indicated that the Colt, the Czechoslovakian gun and the Rheinmetall lacked the necessary qualifications. Other trials followed which narrowed down the choice to the Thompson design and the Garand. The Thompson was finally eliminated in 1940 following tests at Camp Perry, Ohio. The Garand was left master of the field.

Men who fired the guns compared them for action, efficiency, ability to fire under any and all conditions, ease of firing, ease of handling, ease of disassembling, and finally, weight. Guns were tested under the most difficult conditions, and those found lacking were immediately rejected. Meanwhile the Marine Corps, which is allowed its own choice of basic weapons, also compared many types and various modifications of existing small arms in a separate series of competitive tests. Marines who used the M1 during World War II and through the Korean fighting were high in praise of its fire power, striking capacity and versatility.

Springfield Armory was itself one of the pioneers in the development of the principle of "Interchangeability of parts," an outstanding contribution of American industry to the manufacturing world. In 1822, Thomas Blanchard, an employee at the Armory, designed a machine for turning gun stocks. It was the forerunner of all machines, models or forms which are now used to make every rifle part interchangeable. The original Blanchard machine, incidentally, is still on display at the Armory.

The Armory today is the small arms center of the United States Army. Here are concentrated the Ordnance Corps facilities for experimental development of hand weapons (including rifles and automatic weapons of large calibers) and also for pilot line production. Besides being the nerve center for small arms research, it is the repository of the latest production techniques and newest developments in the art of military gun making.

In furtherance of its key role in the design and development of military arms, the Armory maintains a Research and Development Division as its major continuously operating component. This division, functioning under the staff supervision of the Research and Development Division in the Office of the Chief of Ordnance, learns what the user—the Army—wants. Once the military characteristics of a new weapon have been determined,



*After seeing this "rifle organ" at the Armory museum, Henry Wadsworth Longfellow was inspired to write his famous poem on "The Arsenal at Springfield" beginning* "This is the Arsenal. From floor to ceiling/Like a huge organ, rise the burnished arms." U. S. Army Photograph

the Armory must, through its own staff and by calling on the technical talent of the arms industry of the country, bring forth weapons to suit those requirements. In some cases—pistols, revolvers and shotguns, for example—these can be met by utilizing an existing civilian design. Once the Division develops the weapons, it submits them for test by the user, and after satisfactory prototypes are produced, it turns them over for manufacture. The Armory performs a similar service for the Navy and the Air Force.

The Armory's second principal role is one of manufacture. In wartime the bulk of production is assigned to civilian industry for economic as well as security reasons. In time of peace, continuing efforts must be made to enable civilian factories, when called upon in the event of mobilization, to produce military weapons quickly and in quantity. Civilian producers must know what they are to make and how to make it in quantity; moreover, they must have the proper machine tools and fixtures.

Acting in accordance with mobilization plans which determine quantities and time schedules, the Armory decides which civilian

facilities will be utilized to produce the required items. During the Korean War, the Armory not only provided drawings and specifications but descriptions of manufacturing processes as well. It organized technical teams to provide guidance in production methods and it furnished assistance in obtaining special machine tools. To do this, it drew upon its experienced personnel.

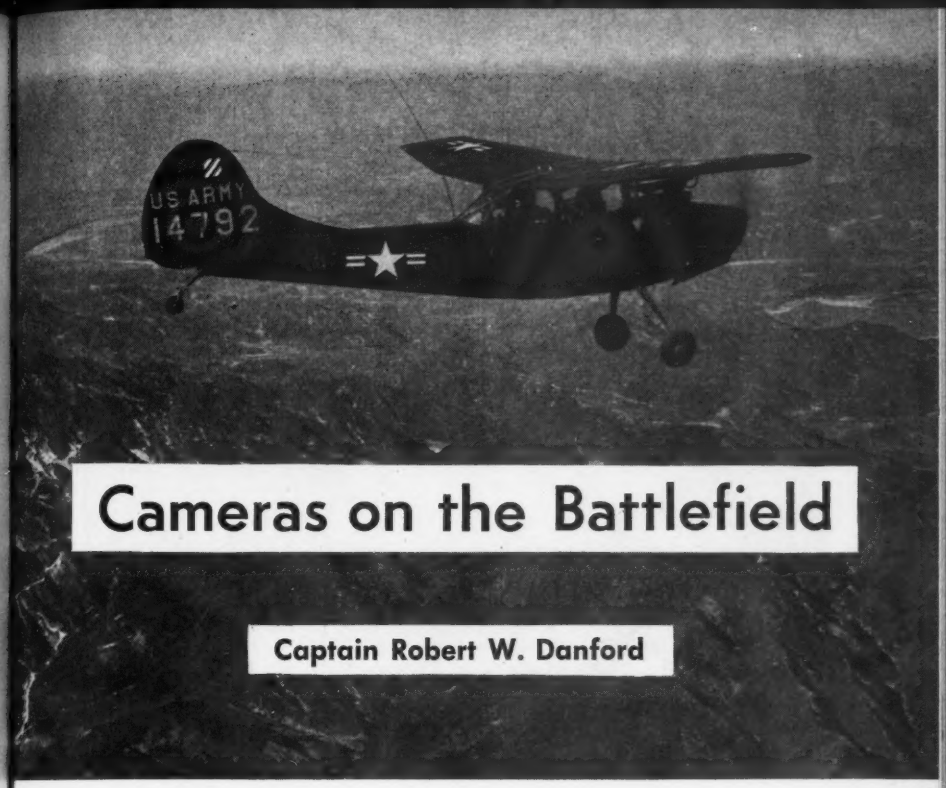
But before the Armory can pass on its knowledge, it must acquire the actual experience itself. As an example, a special weapon of limited application must be made in a hurry. The Armory is required to have an extra production capacity to handle such "crash" items on a priority basis. Thus there are two facets to the Armory's manufacturing role—learning how to make new items, and guiding others in their fabrication.

The inspection function is closely related. The Final Inspection Division insures that Armory products measure up to specifications. It also checks civilian-produced items for conformance to standards. The Inspection Division trains Ordnance inspectors assigned to civilian plants and exercises supervision over them. Checks on resident inspectors are conducted periodically by calling in samples of lots that these inspectors have accepted and running rigorous tests.

The third operating division of the Armory is the Field Service Division, which receives the finished inspected items from the Manufacturing Division, stores them and finally ships them on demand. The Armory, however, is not a major storage point since it has only sufficient space to enable orderly shipments to be made to storage depots or using troops.

In effect the Armory's role is three-fold—it develops new arms; it guides the production of arms in the United States while producing some itself, particularly "crash" items; and it ships them to Army users. In wartime this role differs only in scale and extent, so far as production is concerned. The development role, on the other hand, is constant in volume and intensity, both in peace and in war.

Throughout one hundred and sixty years, the name Springfield Armory has been synonymous with high standards. Its workers are skilled artisans. Pride in their craftsmanship, together with a willingness to work and a standard toward which to point, has resulted in peak production and superior results—"the best small arms in the world."




# Cameras on the Battlefield

**Captain Robert W. Danford**

COMMANDERS from platoon through division level are finding photography a valuable tool in support of combat operations—so much so that the demand for tactical photography, both from the air and on the ground, is steadily increasing.

Reconnaissance Wings of numbered Tactical Air Forces are responsible for providing Army units with tactical aerial photography, generally from the line of contact with the enemy forward to a depth of approximately one hundred miles. This coverage (basic, frontline and special) usually ranges in scale from 1:12,500 of larger areas to 1:500 of selected limited areas. Oftentimes however, such factors as time, space and weather preclude the timely procurement and delivery of this type of aerial photography for Army intelligence purposes.

Army photography (taken at altitudes up to eight thousand feet from aircraft organic to divisions and corps) is supplementary to the tactical aerial photography provided by an Air Force Tactical Reconnaissance Wing. Depending on the weather and the capability of Army aircraft in penetrating enemy territory at an altitude facilitating the use of Signal Corps cameras,

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*Overlapping views of enemy-occupied terrain are pasted together to provide a panoramic scene of the front line which (below) soldiers in forward observation posts use in spotting enemy activity.* U. S. Army Photographs

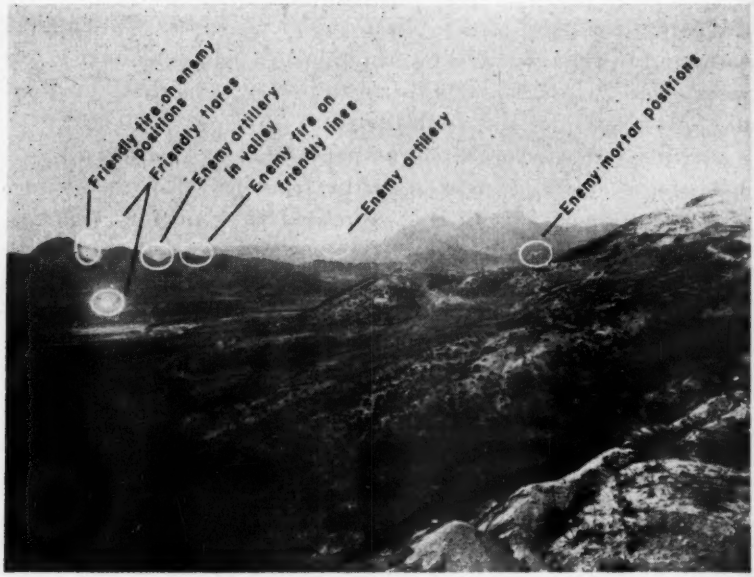
this supplementary Army photography provides commanders with timely and valuable information. G2 Air personnel at divisions and corps also should utilize this photographic medium to the maximum of its capability.

Providing that a target can be penetrated by division aircraft operating from airstrips well to the front and also that Signal photo reproduction facilities are located at or near these strips, Army aerial photography can be procured, processed and delivered in a minimum amount of time to meet the immediate-type requests of frontline commanders. These speedily prepared prints help commanders to determine the presence of woods, roads, bridges and other important terrain features. They are also used to locate enemy road blocks, mine fields and troop concentrations, to survey camouflage discipline of bivouac areas, gun emplacements, fox holes, command posts and observation posts, and to check march discipline of vehicles and troops.

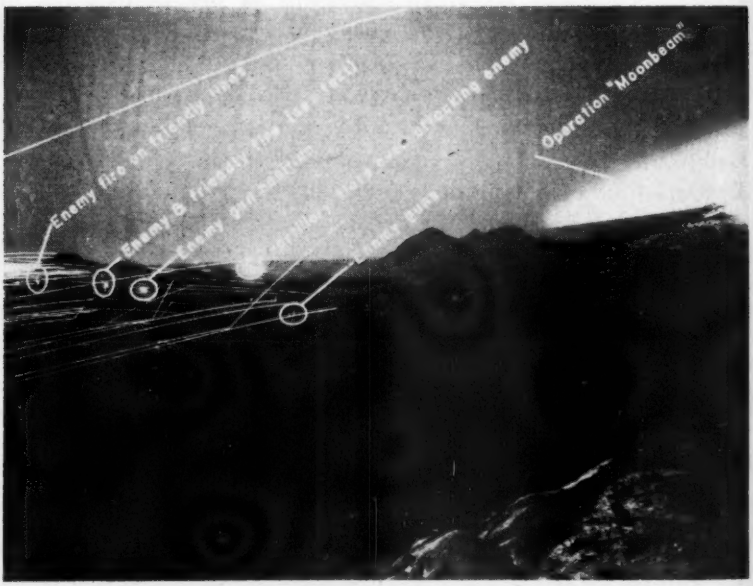
Photographs taken from ground observation posts are another valuable source of information for tactical commanders. Panoramic strip photographs, annotated with the names of prominent terrain features, are used by units providing fire support. Patrols, too, are briefed by this method.

Because tactical intelligence is a perishable commodity, increasing emphasis is placed on speed in the preparation of finished prints. The use of Army facilities for the procurement of limited quantities of close-in aerial pictures has done much to meet the requirements of tactical commanders for immediate photographic reconnaissance. Recently, in a demonstration at Camp Rucker, Alabama, sixty complete photographs were delivered to the commanding general only sixty-three minutes after Army aircraft flew over the target.

Tactical aerial photography is a form of close support and consists of two types—pre-planned or immediate. Aerial photography flown for the Army by a reconnaissance wing of a tactical air force is generally pre-planned whereas that flown by Army aircraft is usually an immediate mission. A frontline commander requiring aerial photography makes his request through intelligence channels to the Division G2 Air. Such a request—pre-planned or immediate—when made by division units is of a "special cover" nature. G2 Air determines whether the request can be fulfilled by Army facilities or should be sent to Joint Operations Center for action. Whenever possible, such requests




*Flashes recorded on photographic film reveal enemy gun positions. Below, the same sector of the Korean front at night.* U. S. Army Photograph



should be fulfilled by Army, especially requests for immediate special cover. Speed is vital when targets appear and disappear quickly. At division level where aircraft and photo processing equipment are readily available, and pilots and photographers are particularly well acquainted with the tactical situation and the terrain, Army procurement of aerial photography is normally expeditious and highly efficient.

Aerial cameras presently available in corps and division photographic sections can produce a variety of useful prints. These include vertical and oblique stereos with 60 percent overlap, vertical strips, oblique strips and vertical and oblique single frame exposures. While the equipment cannot produce controlled mosaics or controlled strips for aerial mapping or fire control operations, the uncontrolled mosaics can be assembled and re-photographed for printing and distribution.

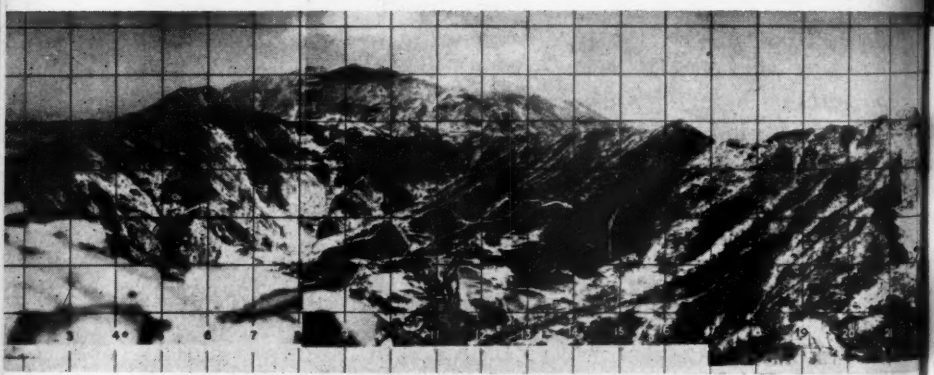
Battalion commanders and intelligence personnel at division and corps are generally the most active in requesting low level, special cover aerial photography. As a rule, units below division desire oblique photographs of the terrain while larger units need vertical strips and stereo pairs. The photographs are used for such varied purposes as selecting specific artillery targets, briefing patrols, studying terrain for future routes of advance and outpost locations, searching for enemy camouflage (especially during seasonal changes), checking on enemy movements in snow, and studying enemy bunkers, trenches and field pieces.

At division level the G2 Air co-ordinates with Signal and Aviation officers to determine whether or not the request can be fulfilled by organic means. If so, G2 Air personnel brief the pilot and photographer on the mission and arrange for any necessary interpretation of the photographs and dissemination of intelligence gleaned from the pictures, the pilot or the photographer himself. The Signal Officer arranges for processing and expeditious delivery of finished photography. Normally Signal Corps personnel operate the cameras but any properly trained individual may be used. These specialists handle the necessary administrative details of processing the film and delivering prints to the requesting agency. Developing and printing is done by division and corps photographic sections, most of which maintain mobile dark-rooms at or near airstrips.

In aerial photographic missions, a high degree of co-operation is necessary between pilot and photographer. The pilot is respon-

sible for the flight plan and approach, for placing the plane over the target and for the safe operation of the plane. The photographer prepares the cameras, makes the required exposures and delivers the film to the laboratory. He also maintains a log in which he enters all data needed to identify the location and scale of the photographs. Because teamwork is highly essential in aerial photography, pilot-photographer teams should be formed whenever possible. An equitable assignment of missions, particularly those of an especially hazardous nature, will do much to assure success.

All photographic units in Korea made panoramic strips from ground observation posts. When a new sector was assigned, photographers were sent out with the troops. As the outpost was dug in and wires were strung, a photographer used a wide-angle lens equipped camera and a tripod and took a series of separate pictures, both on panchromatic and infra-red film. These, matched together and pasted, formed a long strip-photo providing a panoramic view of the terrain, in a 120 degree arc, in front of the outpost. A one-inch grid system was superimposed, with horizontal lines denoted by letters, vertical lines by numbers. This afforded a simple but effective method of pinpointing on the photograph a corresponding spot on the ground. Names of prominent terrain features, such as hills and stream junctions also were overprinted.



*A one-inch grid system is superimposed to facilitate reference to sectors where suspicious enemy activity has been noted.* U. S. Army Photograph

Copies were made and distributed to adjoining observation posts, battalion, regimental and divisional headquarters, and supporting artillery units. While they were not used to replace

maps and overlays, they served as a valuable supplement, conveying additional information beyond the scope of a map—details such as enemy fortifications, camouflage, equipment.

These strips were used by division and regimental commanders to orient military observers and inspecting parties with details of the action under surveillance. Battalion commanders used them to explain plans for a patrol or a raid to company commanders, who in turn used them to brief patrol leaders. The strips also were employed for target location and fire support. One observation post could "talk" another observation post onto a target. OP No. 1, for example, could telephone OP No. 3 and report muzzle flashes at a certain location, using one of the panoramic strips for mutual reference. In the same manner, a forward observer could communicate information to the battalion S2 with great speed and accuracy.


*Landsmarks are identified on the panoramic strip.* U. S. Army Photograph

Photo strips proved especially valuable in Korea where troops of different nationalities and languages fought side by side. In such cases, the panoramic photograph was worth far more than the proverbial ten thousand words.

Non-English-speaking soldiers in American units learned the English words for familiar terrain features and for tanks, trucks and other targets of opportunity that appeared on the battlefield. Thus, when an officer briefed a patrol, he could refer to his strip-photo and point out explicitly to his men the details of the terrain they were going to traverse, with perfect assurance that the idea was getting across to the whole patrol.

Army photography today, more than ever, provides a source of vital information for the ground commander and his staff.

# New Frontiers In Oceanography

**Richard C. Vetter**

COINCIDENT with the twenty-fourth anniversary of the Woods Hole Oceanographic Institution, a new and fully equipped Navy Laboratory of Oceanography has been added to facilities which have made the Woods Hole sector of the Massachusetts coast renowned as a center for research in the ways of the ever-changing sea. The new laboratory, an activity of the Office of Naval Research, will be operated by the Woods Hole Oceanographic Institution under contract with the Navy.

Oceanographic research began at what was originally the small fishing village of "Woods Hall" shortly after the Civil War with the establishment of the first permanent sea coast laboratory there. Because the area was particularly adapted to this type of study, it attracted other related activities—the Marine Biological Laboratory and the United States Fish and Wildlife Service before the turn of the century; the Woods Hole Oceanographic Institution, founded and endowed by the Rockefeller Foundation for study of marine biology and oceanography in 1930; and now the Navy's new Laboratory of Oceanography. Prior to World War II, research was conducted at Woods Hole in all phases of marine science, including hydrography, biology and geology, and vessels belonging to the Institution sailed the Atlantic and the Mediterranean collecting data.

Early in World War II the Navy turned to the oceanographic laboratories for help in countering the menace of enemy submarines. There, scientists worked on problems ranging from underwater sound to the effect of underwater explosions. That

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the United States was eventually able to win the fight against German submarines was due in a large measure to new techniques for undersea warfare based on fundamental research by these laboratories. The new facility is designed primarily to solve naval problems, but many by-products of direct benefit to the national economy are expected to accrue.

The scope and importance of oceanography—the study of oceanic life and phenomena—is evident in the fact that over 70 percent of the globe is covered by salt water. Of necessity, oceanography draws heavily on the basic sciences. Though it is a relatively young science (most important scientific papers in the field are considerably less than fifty years old), and a rather small one (there are less than two hundred oceanographic scientists in the United States) oceanographers have already made significant contributions in the fields of large scale turbulence and hydro-dynamics, in studies of the influence of high hydrostatic pressure on microbiological processes and others.

The role of the oceanographer is to develop order out of chaos and to extract concepts of reality, one by one, from an extremely unco-operative ocean. His ultimate goal is to understand the ocean as a composite interrelated entity.

As a first step, it is necessary to obtain a description of the ocean, including an accurate picture of the distribution of marine plant and animal life, the physical and chemical properties of different water masses, the location of oceanic basins, submarine mountain ranges and canyons, and other basic data. This in itself is a formidable task. Even today, the topography of that face of the moon directed toward the earth is known in greater detail than is the topography of the ocean bottom.

Why is it important to obtain complete understanding of the ocean? The answer is most clearly seen by comparing the ocean and the atmosphere. For some purposes, it is sufficient to know that the average temperature of the ocean off Cape Hatteras in February is 20 degrees Centigrade. Likewise for some applications it is useful to know that the average rainfall during July in Lynchburg, Virginia, is 10.52 centimeters. This information about average weather conditions in various parts of the United States, though important, is of limited use. But there is considerable advantage in knowing, in addition, what the weather is like at a given place at a given instant, and of being able to forecast future weather changes. The same is true of the ocean.

If the thermal structure of the ocean in a given location can be forecast, then naval personnel can more readily take advantage of optimum sound transmission conditions in submarine and anti-submarine operations, for example.

Many applications of oceanographic research now just over the horizon would have been considered virtually impossible a few years ago. Characteristics of the ocean at any given time can now be determined over a large area and a successful beginning has been made in predicting small-scale changes. Although knowledge of average conditions in the ocean will continue to be useful, and classical methods of determining them are still necessary and justified, research can now be expanded more than had been dreamed possible heretofore. These advances are all the more amazing when it is considered that only a few generations ago mankind was in the dark ages with respect to oceanographic research.

Magellan, while sailing on the Pacific Ocean about 1520, found time one calm afternoon to make an attempt at determining the depth of that newly discovered body of water. He fastened a heavy weight to the end of a few hundred fathoms of line and had it lowered over the side. He found "no bottom" and entered the fact in his log along with a comment to the effect that this must surely be the deepest spot in the ocean! Both his instruments and his theory as to the depth of the ocean were inadequate. It is now known that he must have been in over two thousand fathoms of water, which is an "average" depth for the Pacific Ocean.

Even with the advent of the famous *Challenger* expedition (1872-1876), organized by the British government to explore "the open ocean," methods for making oceanic soundings were still rather crude. Successful deep soundings were made but the process involved was so time consuming that one or two soundings a day in deep water were all that could be made. The sounding line was marked at equal 100-fathom intervals, a heavy weight fastened to the end, and the line permitted to run out freely over the side. As it passed over the rail the time of passage of each 100-fathom mark was recorded. The time intervals between successive marks gradually increased because of the increasing friction of the line in the water. When the sounding weight finally struck the deep ocean floor the only effect at the surface was to change the rate of increase of time interval.

Using this method, the *Challenger* expedition scientists were able to determine the general shape of the ocean basins in reasonable agreement with the topography as it is believed to exist today. For them to have determined the topography in any greater detail would have been out of the question considering the primitiveness of their equipment.

Consequently, the accepted concept of the ocean floor for many years was much the same as the mental picture a visitor from another world might obtain by flying over the United States at night at a height of about 20,000 feet making measurements of his altitude by radar every 100 miles. Such a visitor would have no idea of the roughness of the Rockies, might just possibly detect the Appalachians, and would not even discover such "small" features as the Grand Canyon.

For many years reputable scientific references pictured the bottom of the ocean as possessing little relief and, strangely enough, theories of submarine geology were formulated explaining why this should be so. The true topography of the ocean floor was completely masked from scientists of the day because of technical inadequacies. Sounding devices could only measure depths within a hundred fathoms; the position of the ship making the sounding could be determined only approximately and the number of soundings possible on any given occasion was small indeed.

The development, much later, of new devices like the echo sounder made detailed study of bottom topography feasible. This instrument has become an acoustic spotlight on an otherwise dark ocean bottom, bringing knowledge of countless mountains, mountain ranges, submarine canyons, vast rolling plains and basins. As a result, the past few years have seen a careful re-examination of previous theories of submarine erosion, deposition and formation of oceanic features.

Certain features of the ocean dominate any study of its phenomena. Among the more important of these, but not always the most obvious, is its very vastness. This single factor has been a considerable handicap to man in his attempt to understand the ocean. Another characteristic is that it changes from place to place and from time to time. Water masses of completely different identity are often found in close proximity to each other and the exact boundary between the two may never appear just where it is expected. For certain oceano-

graphic studies seeking information on average characteristics this has not been a particularly disturbing feature, inasmuch as oceanographers were able to assume that small changes in time and position were relatively unimportant. But such variations are extremely important when the matter of forecasting what a given part of the ocean is apt to be like at a given instant of time, is involved. Fortunately, the necessity for such added information has coincided with the development of theories and instruments capable of dealing with an actual, rather than an "average," ocean.

Many of the instruments developed within recent years—notably the bathythermograph and electro-kinetograph—can be operated while the oceanographic ship is underway. By the use of such devices, a large area of the ocean may be explored in a relatively short time and an extensive sampling obtained before the feature under study can change materially.

World War II requirements for underwater detection devices led directly to the development of the bathythermograph or "BT," an instrument which when lowered into the sea produced a graph of temperature change with depth. Since the path of a beam of sound sent out from a destroyer in search of an enemy submarine is determined by vertical gradients in the temperature of sea water, the bathythermograph became an important instrument in submarine and anti-submarine warfare and now serves as a valuable instrument for research in peace.

The device is used to determine the boundaries of warm and cold ocean currents; it also aids in studies of the effects of vertical oceanic turbulence, of changes in depth of the shallow "mixed layer," and of countless other phenomena.

Electrical measurements too have become a standard feature of any oceanographic expedition. The geomagnetic electro-kinetograph or "GEK," is essentially a servo-galvanometer which measures the small electrical potentials developed between its two component electrodes which are trailed about 100 yards apart behind a moving ship. As the cable between the electrodes cuts the earth's magnetic field, it sets up a small electrical potential in the cable. Thus a continuous record is obtained of that part of the ocean current which is perpendicular to the ship's course, and by steaming later at right angles to the previous course, the total surface ocean current can be measured. While presently a research tool, the GEK shows promise of being a

valuable navigational aid with possible commercial applications. The use of instrumented buoys to supplement oceanographic vessels is another important development.

The expense of operating research vessels is by far the largest item in the budget of any oceanographic institution. To reduce the cost of obtaining needed data, expendable buoys have been developed which when released will automatically radio their information to a ship or shore station. Other buoys are being developed which can be anchored in deep water, left for months, and then picked up at the convenience of the survey vessel.

Aircraft have also been successfully instrumented to serve as an oceanographic tool. Two promising airborne instruments include a wide-angle, time-lapse camera and an infra-red radiation thermometer. The camera is capable of photographically recording an entire flight on a short length of motion picture film. The wide-angle lens has the effect of increasing the contrast effect on the photograph so that minor changes in the color and texture of the sea surface show up clearly. Under favorable conditions the Gulf Stream may actually be photographed—sometimes because of a slight difference in color; at other times the slight wind velocity difference between water moving with and water moving against the surface wind is sufficient to produce a noticeable contrast in the white caps.

The other airborne instrument, an infra-red detector, is designed to scan the sea surface vertically from the air and record changes in infra-red radiation. Under optimum conditions, this amounts to taking the sea's surface temperature from the air. Large areas of the ocean can be covered in this manner so that the position of the Gulf Stream, its eddies and swiftly flowing filaments, can be rapidly charted.

The installation of an accurate Loran system (long-range radio navigation) along our coasts has helped the oceanographer's work considerably. Ordinary methods of celestial navigation are such that a ship out of sight of land is seldom able to determine its true location closer than within a radius of three to five miles. Yet a researcher who can not determine his position within a few miles is seriously handicapped in studying a phenomenon which may be only that size or smaller. With good Loran coverage, fixes may be obtained within a few hundred yards every fifteen minutes any time of the day or night. This makes possible the continued checking of an air-

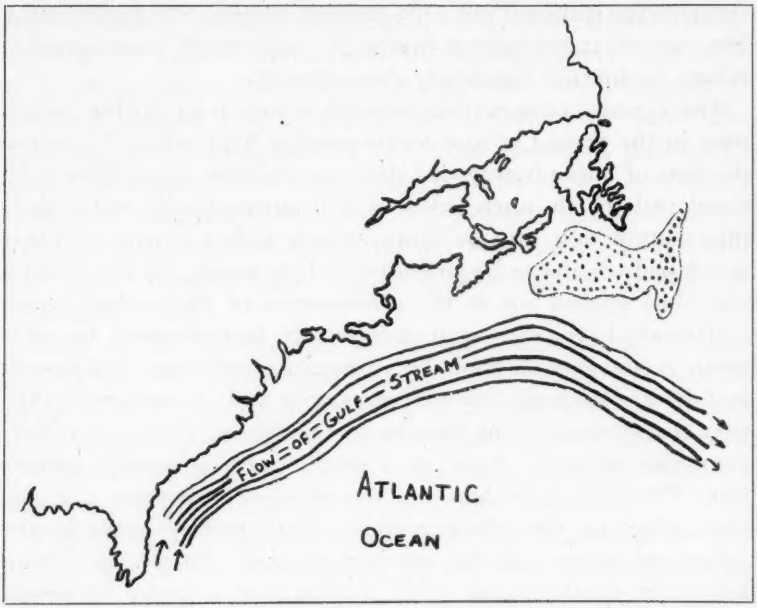
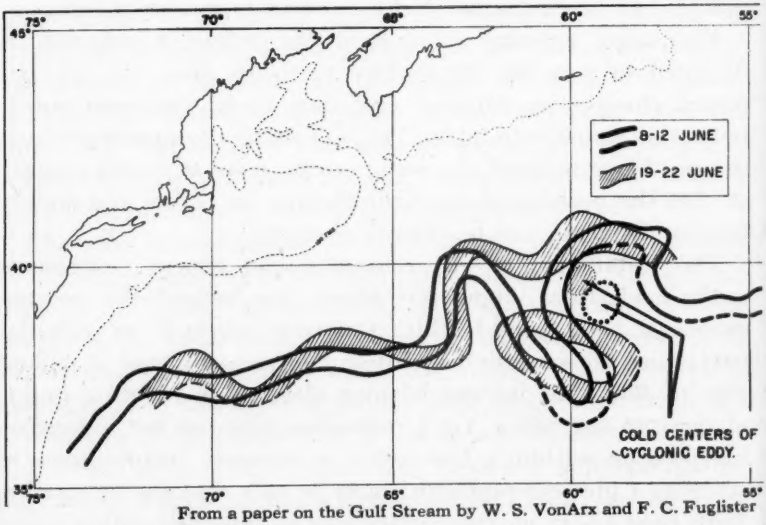



FIGURE 1.

*A chart of the Gulf Stream as depicted by Benjamin Franklin in 1770.*




From a paper on the Gulf Stream by W. S. VonArx and F. C. Fuglister

FIGURE 2.

*Illustrating the constantly changing nature of the Gulf Stream, this chart shows how its outline varied after a seven-day interval.*

craft or a ship's actual position so that any change due to ocean currents may rapidly and accurately be determined. The Hydrographic Office and firms operating oil tankers have co-operated in the collection and analysis of data; this has resulted in new charts which show the most favorable route in traversing the Gulf Stream area. Savings in time, operating costs and wages are some of the immediate, practical benefits. In addition, the theorist has been provided with information which sheds new light on the physical processes operative in the ocean deeps.

The Gulf Stream furnishes an excellent example of the changing concept of oceanic movements. An early chart of the Gulf Stream prepared under the direction of Benjamin Franklin about 1770, shows it as a narrow continuous band of water originating between Florida and the Bahamas, flowing north and then northeastward as a gradually widening belt of warm water. *(See Figure 1.)* This picture held for many years and became generally accepted. The velocity was then believed to be about four knots off the Florida coast, slowing to three off Cape Hatteras with a corresponding increase in width from fifteen miles to thirty-two miles at this point. South of the Great Bank of Newfoundland, the Stream was thought to drift eastward at a leisurely one knot. Modern oceanographers still accept this view provided the word "average" is inserted liberally in the description. Increasingly, the facts demonstrate that the Gulf Stream changes its course frequently, contains huge bends which grow, become unstable and finally break off to form separate eddies. *(See Figure 2.)* In addition, it is discontinuous, and contains a series of overlapping filaments—swiftly flowing water sandwiching sections where the water may temporarily flow in the opposite direction. In short, the Gulf Stream is so complicated that it must be considered as a "system" of currents and associated phenomena rather than as an entity.

Indeed, studies of the Gulf Stream System show it to be not unlike the jet stream in the atmosphere, and discoveries in the fundamental hydrodynamic laws governing both phenomena are interchangeable with slight modification. Actually, the Gulf Stream System acts very much like the jet stream of the atmosphere slowed down by about a factor of seven. Consequently, the development of an eddy or any other large-scale change in the Gulf Stream may be studied more leisurely and accurately than the same type of disturbance in the atmosphere.

What can be expected from oceanography in the future? As more is learned about the characteristics of ocean waves, ships may be better designed for efficient operation under adverse as well as optimum conditions. Improved wave forecasting techniques should enable ships at sea to avoid conditions beyond their capacity for safe, comfortable and efficient operation. Effectiveness in the conduct of military operations at sea and around coastal areas will be enhanced. One may even anticipate the day when stabilizing devices will be designed to anticipate wave forces and thus virtually eliminate the tendency for a ship to pitch and roll.

The ocean currents of the world are effective conductors of tremendous quantities of heat from one portion of the globe to another; thus, improved long-range weather forecasting will certainly result from increased knowledge of the variations in currents. Already it has been demonstrated that changes in the Gulf Stream flow in the Straits of Florida are reflected in weather trends in England approximately three years later. It may soon be possible to locate and utilize the swiftly flowing sections of the Gulf Stream and similar currents so that ships may get a free ride on the one hand, or avoid unfavorable currents on the other, in much the same manner that aircraft now regularly take advantage of the atmospheric jet stream.

The sea's potential food resources have hardly been touched. The fishing vessel of the future may utilize acoustic, electrical and possibly even chemical lures and repellents to increase the efficiency of its nets. Already, some fishing vessels are equipped with sonic methods of locating schools of fish. Recent oceanographic research has discovered previously unknown fishing areas, from new tuna grounds in deep Eastern Equatorial Pacific waters, to discoveries making possible the development of a Massachusetts ocean perch industry. Eventually even the great plankton reservoir of food may be harvested.

Among the many changes which may be forecast, one thing is certain. Oceanographic research will continue to provide necessary information so that the vast resources of the ocean may be intelligently exploited for the good of mankind.

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